VOLUME XXIV NUMBER TWO

THE NATIONAL GEOGRAPHIC MAGAZINE

FEBRUARY, 1913

CONTENTS

Map of Central America, Cuba, Porto Rico, and the Islands of the Caribbean Sea
11½ Inches by 19 Inches — Supplement

The Recent Eruption of Katmai Volcano in Alaska
With 57 Illustrations — GEORGE C. MARTIN

Do Volcanic Explosions Affect Our Climate?
With Illustrations — G. C. ABBOT

The Changing Map in the Balkans
With 27 Illustrations and Map — FREDERICK MOORE

The Countries of the Caribbean
With 23 Illustrations — WILLIAM JOSEPH SHOWALTER

National Geographic Society
With Illustrations

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THE
NATIONAL GEOGRAPHIC MAGAZINE
MAP OF
CENTRAL AMERICA CUBA PORTO RICO
GULF OF MEXICO
TROPIC OF CANCER
BANK OF CAMPECHE OR YUCATAN
GULF OF CAMPECHE
GULF OF TEHUANTEPEC
PACIFIC
GULF OF HONDURAS
TEXAS
LOUISIANA
MISS.
ALA.
MOBILE
Baton Rouge
NEW ORLEANS
SAN ANTONIO
HOUSTON
GALVESTON
Port Bolivar
Sabine Pass
Beaumont
Lake Charles
Corpus Christi
Laredo
Nuevo Laredo
Brownsville
Matamoros
NUEVO LEON
Montemorelos
Linares
TAMAULIPAS
Victoria
Tampico
VERACRUZ
HIDALGO
PUEBLA
MEXICO
Tlaxcala
Jalapa
Orizaba
Alvarado
Frontera
Carmen
Campeche
CAMPECHE
Progreso
Merida
YUCATAN
QUINTANA ROO
TABASCO
Juan Bautista
OAXACA
Oaxaca
GUERRERO
Chilpancingo
ISTHMUS OF TEHUANTEPEC
Tehuantepec
Salina Cruz
Puerto Mexico
CHIAPAS
San Cristobal
Tuxtla Gutierrez
Comitan
Tapachula
GUATEMALA
Coban
Quezaltenango
Flores
Belize
BRITISH HONDURAS
SALVADOR
S. SALVADOR
HONDURAS
Tegucigalpa
Managua
Alacran or Scorpion Rf
Arenas Cay
Puerto Angel
Puerto Arista
100°
95°
90°
25°
20°
15°
A
B
C
1
2
3
4

85°
D
80°
E
75°
F
Pensacola
Tallahassee
Jacksonville
St. Augustine
Daytona
Cape Canaveral
Tampa
St. Petersburg
Sarasota
Boca Grande
Cape Romano
Chatham Bay
Cape Sable
Key West
Dry Tortugas
X I C O
STRAITS of FLORIDA
Little Abaco I.
Great Abaco I.
N.W. PROVIDENCE CHAN.
N.E. PROVIDENCE CHAN.
Eleuthera I.
New Providence I.
Nassau
Andros Is.
EXUMA SOUND
Cat I.
St. Salvador or Watling I.
First Landing Place of Columbus Oct. 1492
Rum Cay
Long I.
CROOKED I. PASS.
MARIGUANA PASS.
Crooked I.
Acklin I.
Mariguana I.
CAICOS PASS.
Great Inagua
Little Inagua I.
A T L A N T I C
G R E A T B A H A M A B A N K
HAVANA
Matanzas
NICHOLAS CHANNEL
SANTAREN CHAN.
OLD BAHAMA CHAN.
Pinar del Rio
Cape St. Antonio
Cape Corrientes
C. Catoche
GULF of BATABANO
I. of Pines
Cienfuegos
Trinidad
Camaguey
Holguin
Manzanillo
SIERRA MAESTRA
SANTIAGO
Guantanamo
Cape Maysi
Cape Cruz
GULF of GUACANAYABO
YUCATAN CHANNEL
Cozumel I.
G R E A T E R
Little Cayman
Cayman Brac
Grand Cayman
Georgetown
Misteriosa Bank
JAMAICA
Montego Bay
Falmouth
St. Ann's Bay
Port Maria
Port Antonio
Savanna la Mar
Black River
Mandeville
KINGSTON
Spanish Town
Morant Pt.
Portland Pt.
Pedro Bank
Morant Cays
WINDWARD PASSAGE
Mole St. Nicolas
Gonave I.
Cape Haitien
HAITI
Jeremie
Jacmel
Swan Is.
HONDURAS
Cape Cameron
Patuca Pt.
Cape False
C. Gracias á Dios
Rosalind Bk.
Serranilla Bk.
Bajo Nuevo
Serrana Bk.
Quita Sueño Bk.
Roncador Cay
Old Providence I.
St. Andrews I.
Albuquerque Cays
Bluefields
Monkey Pt.
NICARAGUA
Tegucigalpa
Managua
Granada
Leon
Rio Hacha
C. Augusta
Sta Marta
C A R I B B E A N

85°
D
80°
E
75°
F
Pensacola
Tallahassee
Jacksonville
Fernandina
St. Augustine
Cape San Blas
Cape St. George
Apalachee Bay
Cedar Keys
Cape Canaveral
Tarpon Springs
Tampa
St. Petersburg
Sarasota
Boca Grande
L. Okeechobee
Oyster Bay
Cape Romano
Chatham Bay
Cape Sable
Florida Bay
Miami
Dry Tortugas
Key West
STRAITS of FLORIDA
NICHOLAS CHANNEL
SANTAREN CHAN.
Little Abaco I.
Great Abaco I.
Bahama I.
N.W. PROVIDENCE CHAN.
N.E. PROVIDENCE CHAN.
Berry Is.
Nassau
New Providence I.
Eleuthera I.
Palmetto Pt.
Andros I.
GREAT BAHAMA BANK
TONGUE OF OCEAN
EXUMA SOUND
Cat I.
Salvador or Watling I.
Rum Cay
Long I.
CROOKED I. PASS.
Crooked I.
MARIGUANA PASS.
Mariguana I.
CAICOS PASS.
Acklin I.
Great Inagua
Little Inagua I.
OLD BAHAMA CHAN.
ATLANTIC
BAHAMA IS.
HAVANA
Matanzas
Pinar del Rio
Cape St. Antonio
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GULF of BATABANO
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Trinidad
Camaguey
Cayo Romano
Puerto Padre
Holguin
Manzanillo
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SIERRA MAESTRA
SANTIAGO
Cape Cruz
Guantanamo
Cape Maysi
WINDWARD PASSAGE
YUCATAN CHANNEL
GREATER
CUBA
Cozumel I.
Little Cayman
Cayman Brac
Georgetown
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Misteriosa Bank
JAMAICA
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Port Antonio
KINGSTON
Morant Pt.
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Savanna la Mar
Black River
Mandeville
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Beacon Cay
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Cape Cameron
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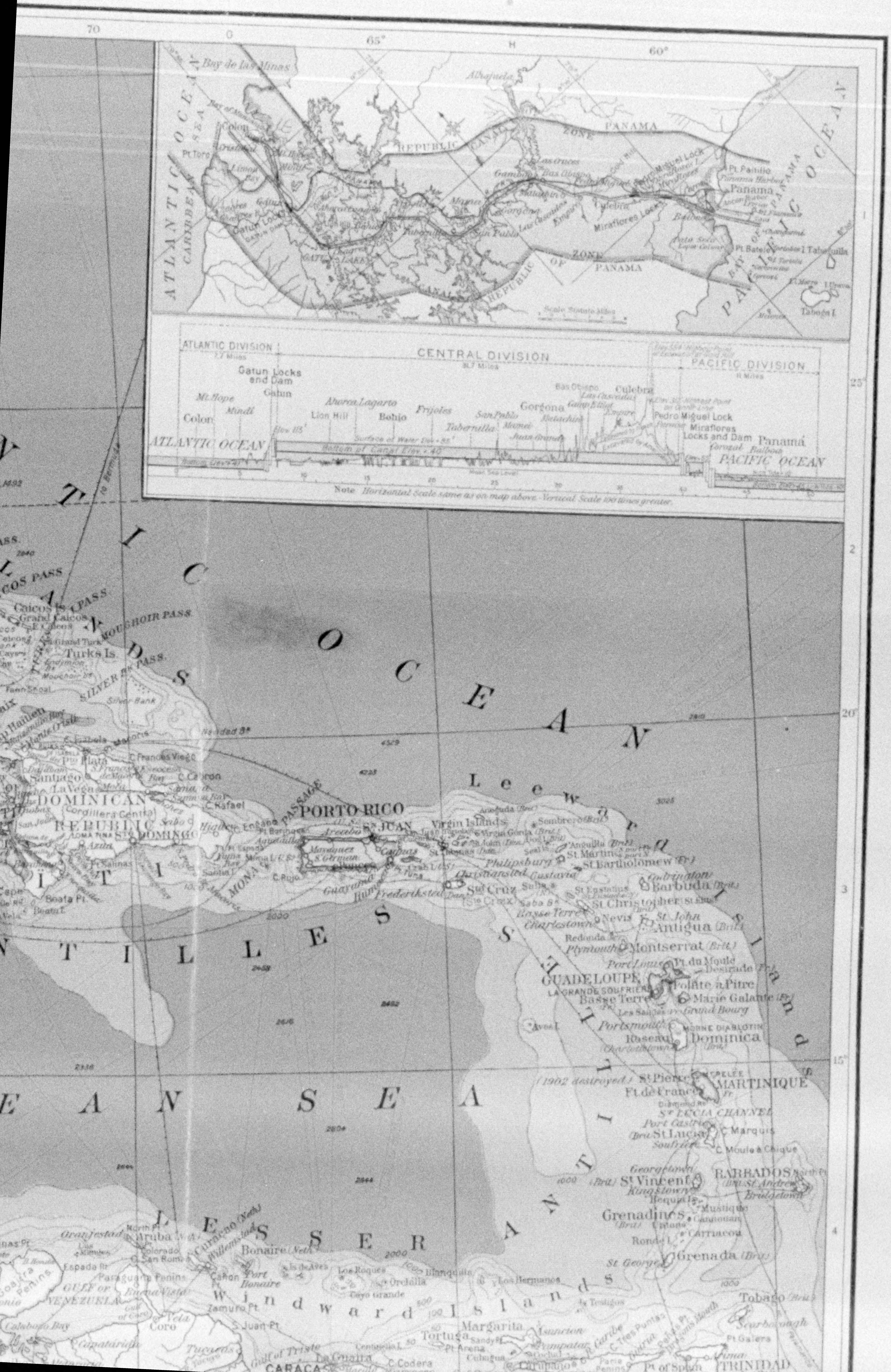
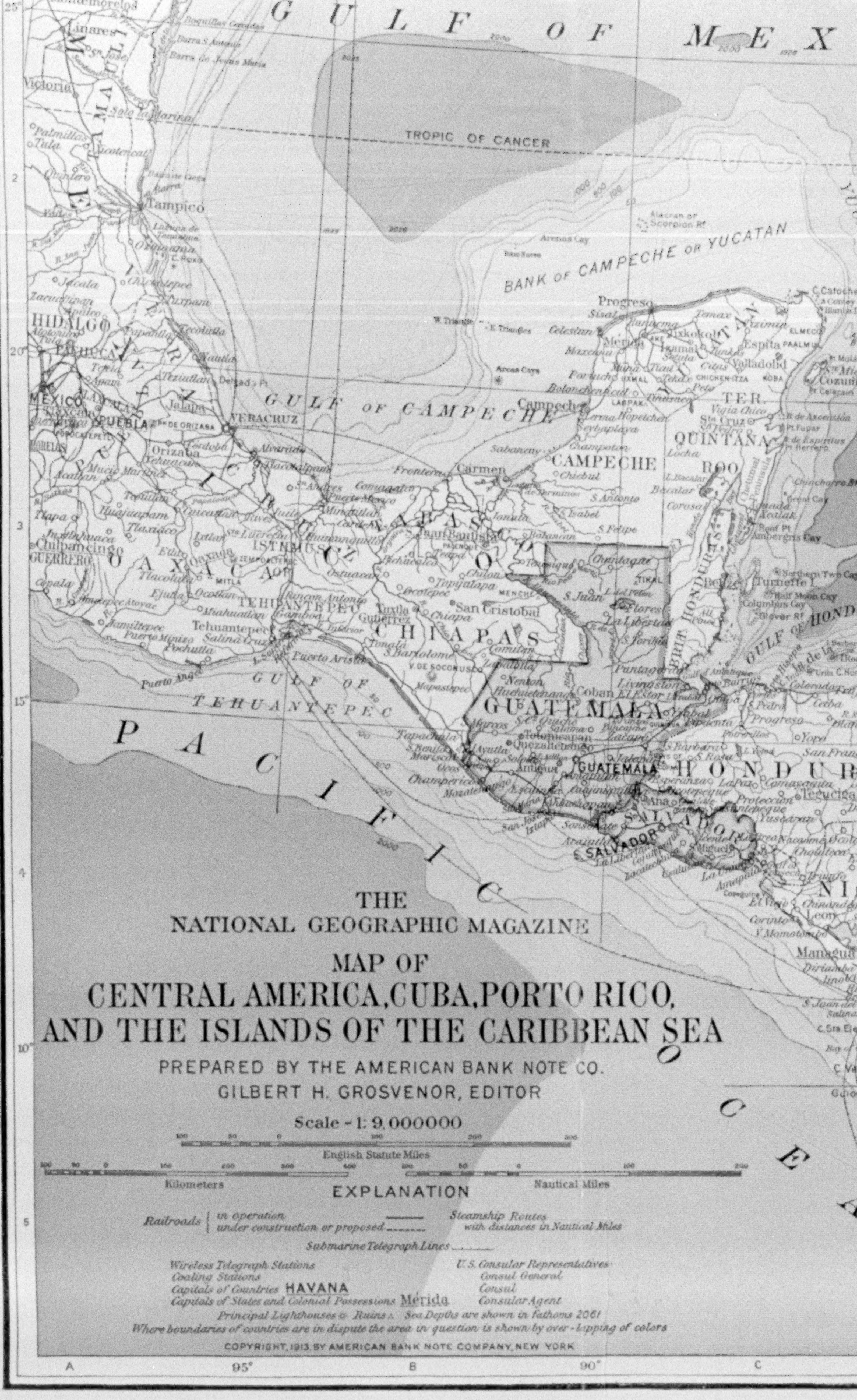
Roncador Cay
Old Providence I.
St. Andrews I.
NICARAGUA
Bluefields
Monkey Pt.
Tiburon
Gonave I.
HAITI
False Cape
Rio Hacha
CARIBBEAN



ATLANTIC OCEAN
CARIBBEAN SEA
Bay de las Minas
Colon
Gatun Locks
CANAL ZONE
REPUBLIC OF PANAMA
PACIFIC OCEAN
Panama
Pedro Miguel Lock
Miraflores Lock
Culebra
Gorgona
Taboga I.
ATLANTIC DIVISION
CENTRAL DIVISION
PACIFIC DIVISION
Gatun Locks and Dam
Gatun
Mt. Hope
Mindi
Colon
Lion Hill
Ahorca Lagarto
Bohio
Frijoles
San Pablo
Tabernilla
Bas Obispo
Empire
Pedro Miguel Lock
Miraflores Locks and Dam
Panama
Note Horizontal Scale same as on map above. Vertical Scale 100 times greater.
O C E A N
Caicos Pass
Grand Caicos
Turks Is.
Silver Bank Pass
Mouchoir Pass
Silver Bank
Navidad Bk.
Santiago
DOMINICAN REPUBLIC
Cordillera Central
St. Domingo
C. Rafael
Samana Bay
Mona Passage
PORTO RICO
San Juan
Arecibo
Mayaguez
Ponce
Guayama
Humacao
Virgin Islands
St. Thomas
St. Croix
Frederiksted
Christiansted
Sombrero
Anguilla
St. Martin
Philipsburg
St. Bartholomew
Saba
St. Eustatius
St. Christopher
Basse Terre
Nevis
Charlestown
Barbuda
Antigua
St. John
Redonda
Montserrat
Plymouth
Guadeloupe
Pointe a Pitre
Desirade
Marie Galante
Grand Bourg
Les Saintes
Aves I.
Portsmouth
Dominica
Roseau
Martinique
St. Pierre
Ft. de France
St. Lucia Channel
St. Lucia
Port Castries
Barbados
Bridgetown
St. Vincent
Kingstown
Grenadines
Carriacou
Grenada
St. George
Tobago
Scarborough
Trinidad
Port of Spain
A N T I L L E S
L E S S E R
C A R I B B E A N S E A
Leeward Islands
Windward Islands
Aruba
Curacao
Willemstad
Bonaire
Los Roques
Orchila
Blanquilla
Los Hermanos
Los Testigos
Margarita
Tortuga
La Guaira
Caracas
Gulf of Venezuela
Paraguana Penins.
Coro
Gulf of Triste
C. Codera
Carupano
Paria Penins.


GULF OF MEXICO
TROPIC OF CANCER
BANK OF CAMPECHE OR YUCATAN
GULF OF CAMPECHE
GULF OF TEHUANTEPEC
PACIFIC OCEAN
GUATEMALA
HONDURAS
CAMPECHE
CHIAPAS
OAXACA
TABASCO
QUINTANA ROO
THE
NATIONAL GEOGRAPHIC MAGAZINE
MAP OF
CENTRAL AMERICA, CUBA, PORTO RICO,
AND THE ISLANDS OF THE CARIBBEAN SEA
PREPARED BY THE AMERICAN BANK NOTE CO.
GILBERT H. GROSVENOR, EDITOR
Scale - 1: 9,000000
English Statute Miles
Kilometers
Nautical Miles
EXPLANATION
Railroads in operation
under construction or proposed
Steamship Routes with distances in Nautical Miles
Submarine Telegraph Lines
Wireless Telegraph Stations
Coaling Stations
Capitals of Countries HAVANA
Capitals of States and Colonial Possessions Mérida
U.S. Consular Representatives
Consul General
Consul
Consular Agent
Principal Lighthouses ☆ Ruins ∴ Sea Depths are shown in fathoms 2061
Where boundaries of countries are in dispute the area in question is shown by over-lapping of colors
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XICO
Key West
Dry Tortugas
STRAITS OF FLORIDA
NICHOLAS CHANNEL
SANTAREN CHAN.
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Andros Is.
Nassau
New Providence I.
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Manzanillo
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BAHAMA CHAN.
Gulf of Batabano
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Isle of Pines
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Cayman Brac
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Grand Cayman
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Swan Is.
JAMAICA
Green Island
Montego Bay
Falmouth
St. Ann's Bay
Port Maria
Port Antonio
KINGSTON
Spanish Town
Black River
Mandeville
Savanna la Mar
Morant Cays
Pedro Bank
Portland Rk.
Banner Reef
Rosalind Bk.
Serranilla Bk.
Beacon Cay
Bajo Nuevo
Gonave I.
REP. OF HAITI
PORT AU PRINCE
Jeremie
Les Cayes
HONDURAS
Bahia
Roatan
Cape Cameron
Patuca Pt.
Cape Gracias a Dios
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Serrana Bk.
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St. Andrews I.
Albuquerque Cays
NICARAGUA
Matagalpa
Managua
Granada
Bluefields
Monkey Pt.
S. Juan del Norte (Greytown)
Limón
COSTA RICA
Pt. Burica
MOSQUITO GULF
CARIBBEE
Bocas del Toro
Colon
Panama
Pt. Manzanillo
Pt. S. Blas
GULF OF DARIEN
PANAMA
GULF OF PANAMA
Coiba I.
Pt. Mariato
COLOMBIA
Cartagena
Barranquilla
Sabanilla
Sta. Marta
Rio Hacha
Pamplona
Bucaramanga
Socorro
MEDELLIN
85°
80°
75°
Longitude West of Greenwich

LUM

GREAT BAHAMA BANK
STRAITS OF FLORIDA
NICHOLAS CHANNEL
SANTAREN CHAN.
CROOKED I. PASS.
MARIGUANA PASS.
CAICOS PASS.
WINDWARD PASSAGE
YUCATAN CHANNEL
GREATER ANTILLES
CARIBBEAN
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Gonave I.
Jérémie
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Les Coteaux
False Cape
HONDURAS
Bahia
Cape Cameron
Patuce Pt.
Cape False
C. Gracias á Dios
Sandy River
Karata
Wounta
Prinzapulca
Barra Rio Grande
NICARAGUA
Matagalpa
Esteli
Perlas
Bluefields
Bluefields Bluff
Monkey Pt.
Granada
Lake Nicaragua
S. Juan del Norte (Greytown)
COSTA RICA
Limón
San José
Cartago
Puntarenas
C. Blanco
Pt. Quepos
C. Matapalo
Pt. Burica
Bocas del Toro
Almirante
PANAMA
Colon
Panama
Pt. Manzanilla
Pt. S. Blas
David
Santiago
Coiba I.
Las Tablas
Pt. Mariato
Pt. Puercos
Pt. Cocalito
Pt. Marzo
COLOMBIA
Sabanilla (Pt. Colombia)
Barranquilla
Cartagena
Rio Hacha
Sta. Marta
Maracaibo
Turbo
Medellin
Bucaramanga
Pamplona
Socorro
85°
D
80°
Longitude West of Greenwich
75°
F

ATLANTIC OCEAN
PACIFIC OCEAN
Colon
Gatun
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Pedro Miguel Lock
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MOUCHOIR PASS
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Santiago
S.t DOMINGO
PORTO RICO
S.t JUAN
MONA PASSAGE
Virgin Islands
Leeward Islands
St. Christopher
Antigua
Barbuda
Montserrat
GUADELOUPE
Basse Terre
Pointe à Pitre
Marie Galante
Dominica
MARTINIQUE
S.t LUCIA CHANNEL
St. Lucia
BARBADOS
Bridgetown
St. Vincent
Kingstown
Grenadines
Grenada
Tobago
TRINIDAD
A N T I L L E S
C A R I B B E A N   S E A
L E S S E R   A N T I L L E S
Aruba
Curaçao
Bonaire
Windward Islands
Margarita
Tortuga
CARACAS
La Guaira
VALENCIA
GULF of PARIA
Cumana
Barcelona
Maturin
Delta of Orinoco
Barrancas
Ciudad Bolivar
Orinoco River
MARACAIBO
Trujillo
Merida
V E N E Z U E L A
BRITISH GUIANA
70°
65°
60°
20°
15°
10°

XUM

The Hamilton Watch

"The Railroad Timekeeper of America"

Engineer H. P. Maybee, of the Erie Railroad, signing the train book before starting his run. He is looking at his Hamilton Watch which has told him the correct time for years.

THE story of the Hamilton Watch is told in a handsome booklet, called "The Timekeeper." It is an interesting story—important to every one who is considering the purchase of a fine watch.

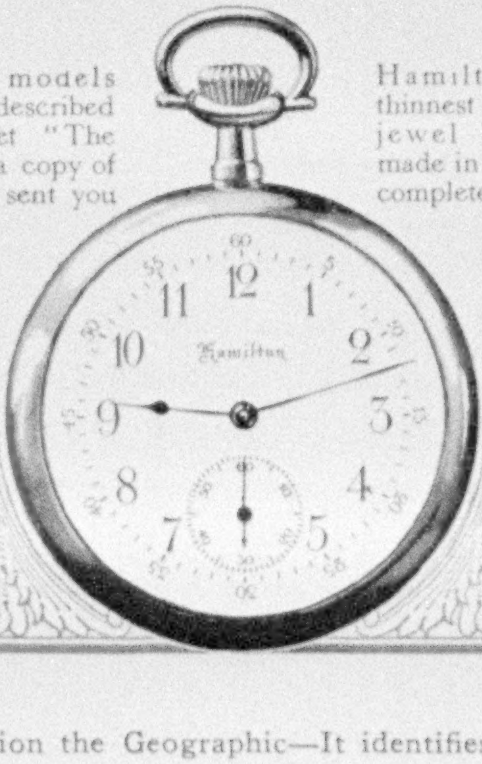
"The Timekeeper" gives the reason why over one-half of the Railroad Men on American roads where Official Time Inspection is maintained carry Hamilton Watches. We gladly send it to any one interested in the purchase of a fine watch.

The Hamilton Watch is made in standard sizes for men and women and is sold by leading jewelers everywhere at $38.50 to $150.00 for complete watches, timed and adjusted in the cases at the factory. In some models, movements only may be purchased, so that you can own a Hamilton Watch, using your present watch case, at a cost of $12.25 and upward. Ask your jeweler. If he can not supply you, write us.

HAMILTON WATCH COMPANY, LANCASTER PENNSYLVANIA

All Hamilton models illustrated and described in our booklet "The Timekeeper," a copy of which will be sent you upon request.

Hamilton 12-Size—thinnest 17, 19 or 23 jewel 12-size watch made in America. Sold complete only.



XUM

It will pay you to place your next policy *in the* Postal Life Insurance Company

Assets *$10,000,000* — 1912—STATE DEPARTMENT AUDIT—1912 — *Insurance in force* *$50,000,000*

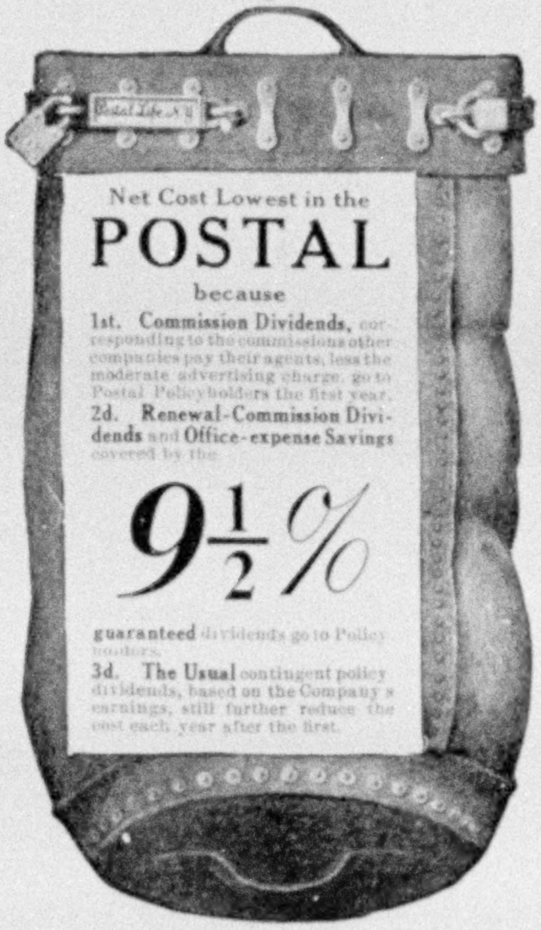
The triennial audit, just concluded, was a most exhaustive inquiry, made possible because the Company eliminates all branch-offices and agents, conducting its business *under one roof*—from a single headquarters, the Home Office in New York.

The inquiry was made thorough because it was the first examination since the Postal absorbed another, and a larger company, and also because the State Superintendent recognized that his official report would be a practical certification of the Company to other State Superintendents: the latter, mindful of the rigid New York requirements and of the strict supervision of its Insurance Department, have agreed that *a company measuring up to New York State standards would be accepted and accredited in other States.*

The outcome is therefore flattering to the Postal Life, and commends it to thoughtful insurers everywhere.

The Chief Examiner of life companies in his statement submitted to the Honorable William Temple Emmet, Superintendent of Insurance, refers to the *high order of the Postal's risks* secured by the non-agency method, and to the progress of the Company in bringing its organization to a *high standard of efficiency*. He adds that the cost of securing business by advertising and correspondence *has not increased* pro rata, with the new business written; the business-getting expense will therefore, as contended by the Company, decrease from year to year. He also adds that part of the cost of advertising should be charged to old business, as continued publicity has a tendency to keep up the confidence of policyholders and retain them.

The examination covers many pages of a printed document on file at the State Department.



Superintendent Emmet, in a memorandum filed with the Examiners' Report December 16th, 1912, calls special attention to the writing of insurance by mail as bringing the policyholders into communication with the home office, and states that the report shows a *general improvement in the condition of the Company.* There is merit, he furthermore states, in the health-work of the Medical Department, not only to the Company and its policyholders but *to the general public as well.*

Particular reference is made to the absence of litigation arising from questions with POSTAL policyholders. He speaks of the number of improvements made in the handling of its business, and points out that *gains have been made notwithstanding the considerable expenditures in 1912 for betterment of the Company's property.*

Thus is the Company commended by the highest authorities to the public. The official endorsements, the conduct of its business through publicity channels, and its operations subject to the United States postal authorities, carry confidence to intending insurers, as well as to its own body of policyholders.

Total Assets and Liabilities

At the close of the examination the Company had over **$50,000,000** insurance in force; the policy and other liabilities were fully covered by statutory and departmental reserves amounting to **$10,029,510.10**, with an excess or surplus to policyholders of **$226,874.55.**

The Company's reserves and other assets are in approved securities, including state, municipal, railroad bonds; bonds and mortgages, real estate, policy loans, accrued interest, deferred net-premiums, cash in bank and various other items, aggregating **$10,256,384.65.**

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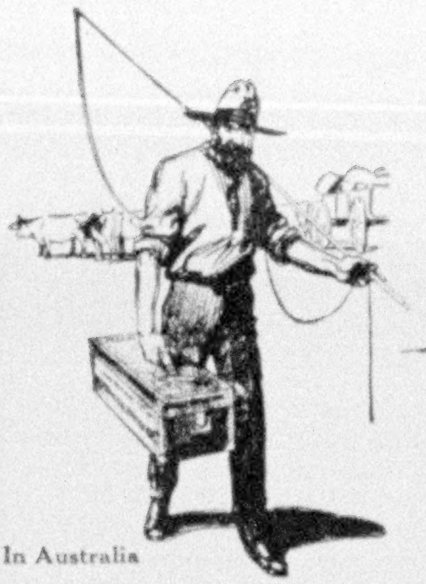

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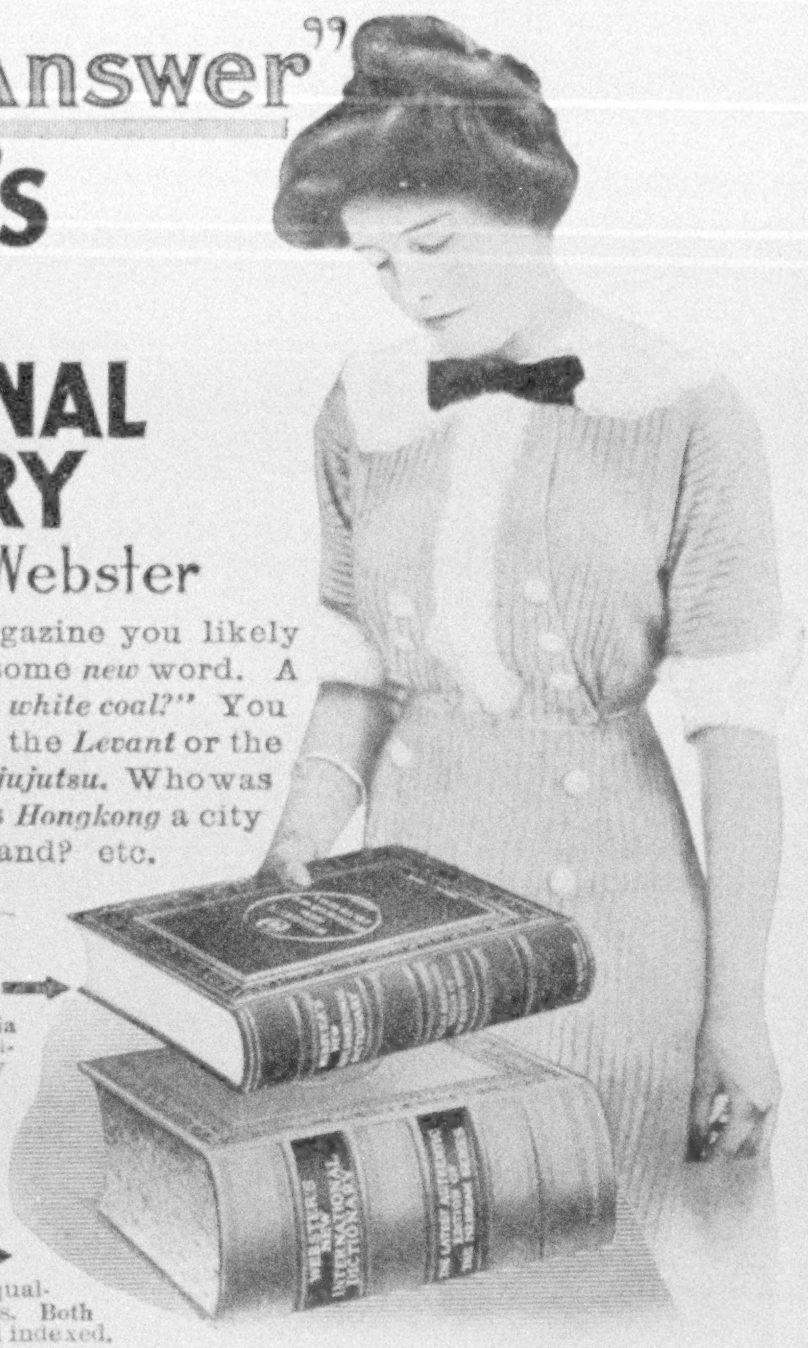

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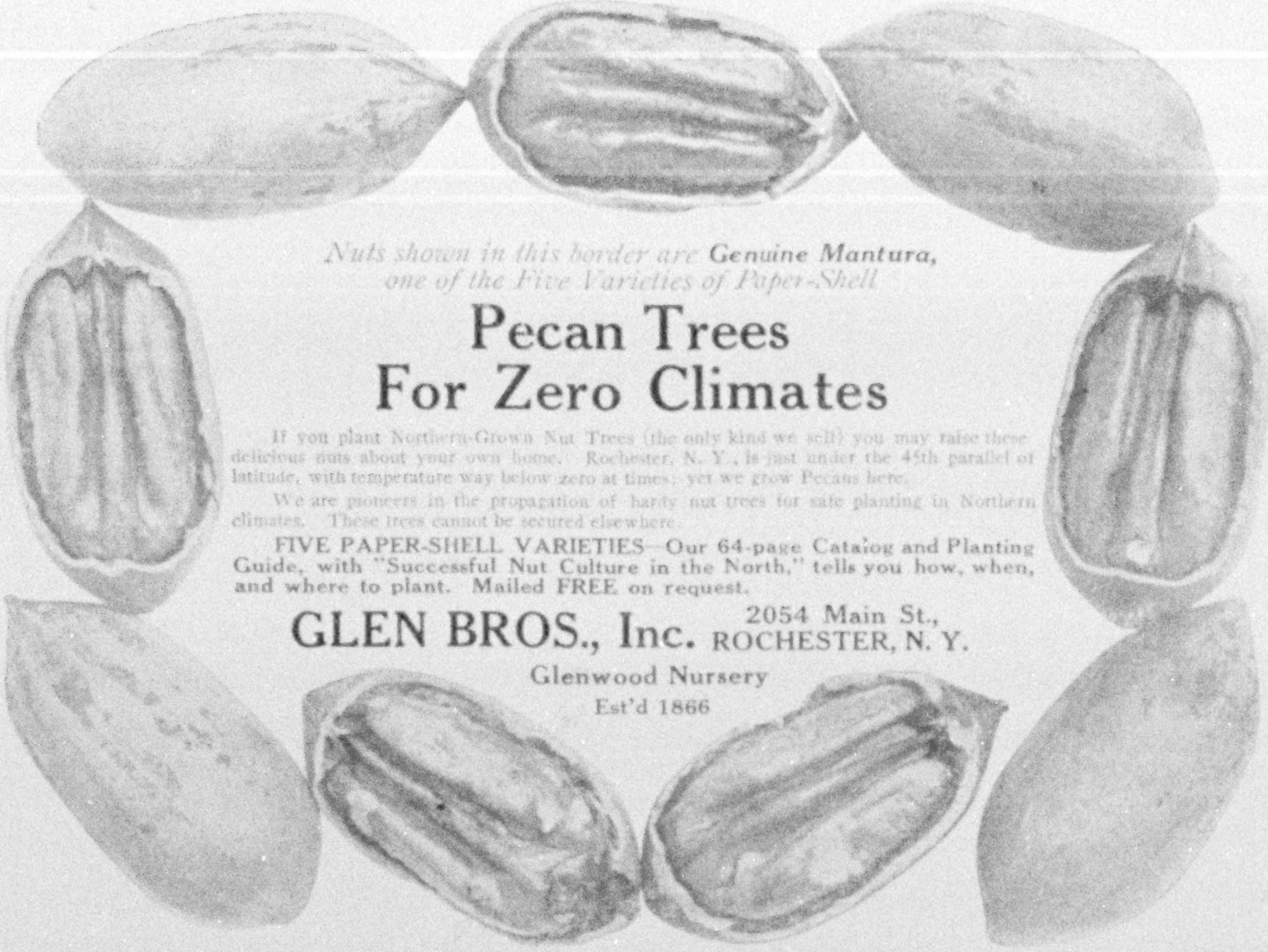

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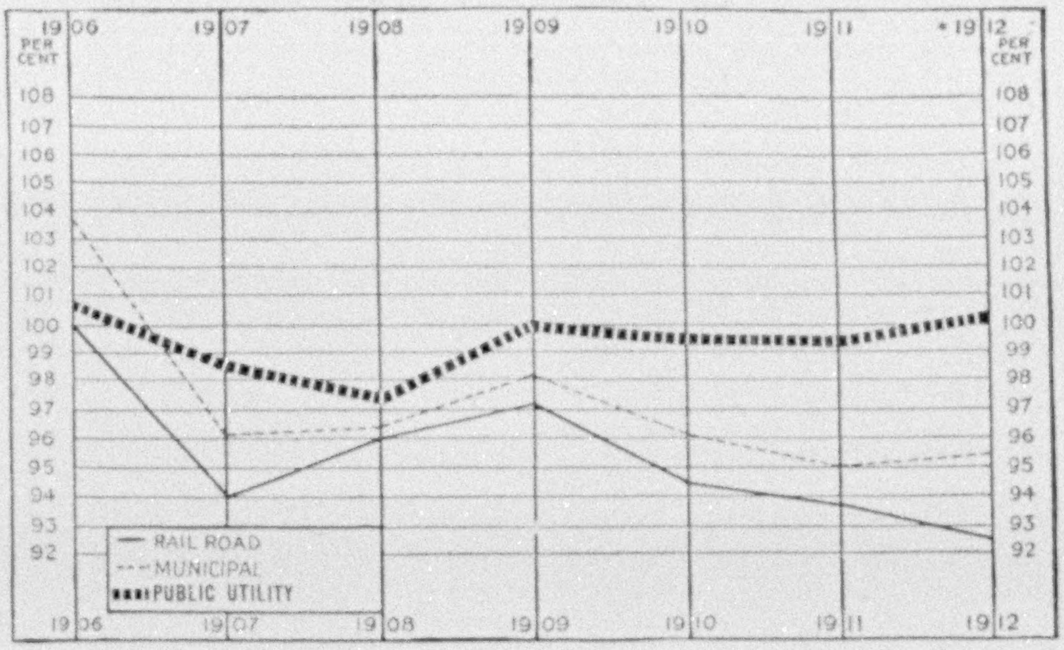

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VOL. XXIV, NO. 2 WASHINGTON FEBRUARY, 1913

THE NATIONAL GEOGRAPHIC MAGAZINE

THE RECENT ERUPTION OF KATMAI VOLCANO IN ALASKA

An Account of One of the Most Tremendous Volcanic Explosions Known in History

BY GEORGE C. MARTIN

Mr. Martin is the geologist of the U. S. Geological Survey who directed the National Geographic Society Alaska volcano researches in 1912

THE volcanic eruption of Mount Katmai, Alaska, of June, 1912, was undoubtedly one of the most violent eruptions of historic times.

This volcano was one of the least known of the many Alaskan volcanic peaks, and had been so long dormant that there were apparently not even local legends of its former outbreaks. No observed warnings of its renewed activity were given other than copious steaming and minor earthquakes. These attracted little attention even among the few dwellers in that thinly settled land, for dozens of other volcanoes along the Alaskan coast steam freely from time to time. The peak is usually hidden in the clouds, and local earthquakes are so frequent as to cause little comment.

Among other people than the few local inhabitants and the comparatively few others who have had occasion to sail through Shelikof Strait, the very existence of Katmai Volcano was doubtless unknown.

Then, without warning, on the 6th of June, 1912, the Katmai Volcano proclaimed itself by a violent eruption. All southern Alaska knew of the event at once, for the sound of the first mighty explosion carried down the coast as far as Juneau, 750 miles away, and was even heard across the Alaska Range at Dawson and Fairbanks, distant 650 and 500 miles respectively.

THE FIRST ERUPTION

Those who did not hear the sound of this first blast, or did not feel the accompanying earthquakes, did not have to wait long for another form of announcement. The column of steam and ash rose several miles in the air and was immediately seen as far away as Clark Lake and Cook Inlet. This cloud of ash was carried eastward by the wind and within a few hours had shed a shower of ashes over all the east end of the Alaska Peninsula, the east half of Kodiak Island, and all of Afognak Island (see map, page 132).

Intense darkness accompanied the fall of ashes. Midnight blackness in the daytime extended as far east as the Kenai Peninsula. Darkness lasted for 60 hours at Kodiak, 100 miles from the volcano. Dust fell as far away as Juneau, Ketchikan, and the Yukon Valley, distant 750, 900, and 600 miles. The fumes were reported from points as remote as Van-

MAP OF THE REGION AFFECTED BY THE KATMAI ERUPTION, SHOWING THE ASH FALL AT VARYING DISTANCES

The thickness of ash is shown by curves of approximately equal depth and by figures showing measured depth in inches (see pages 166 and 176)

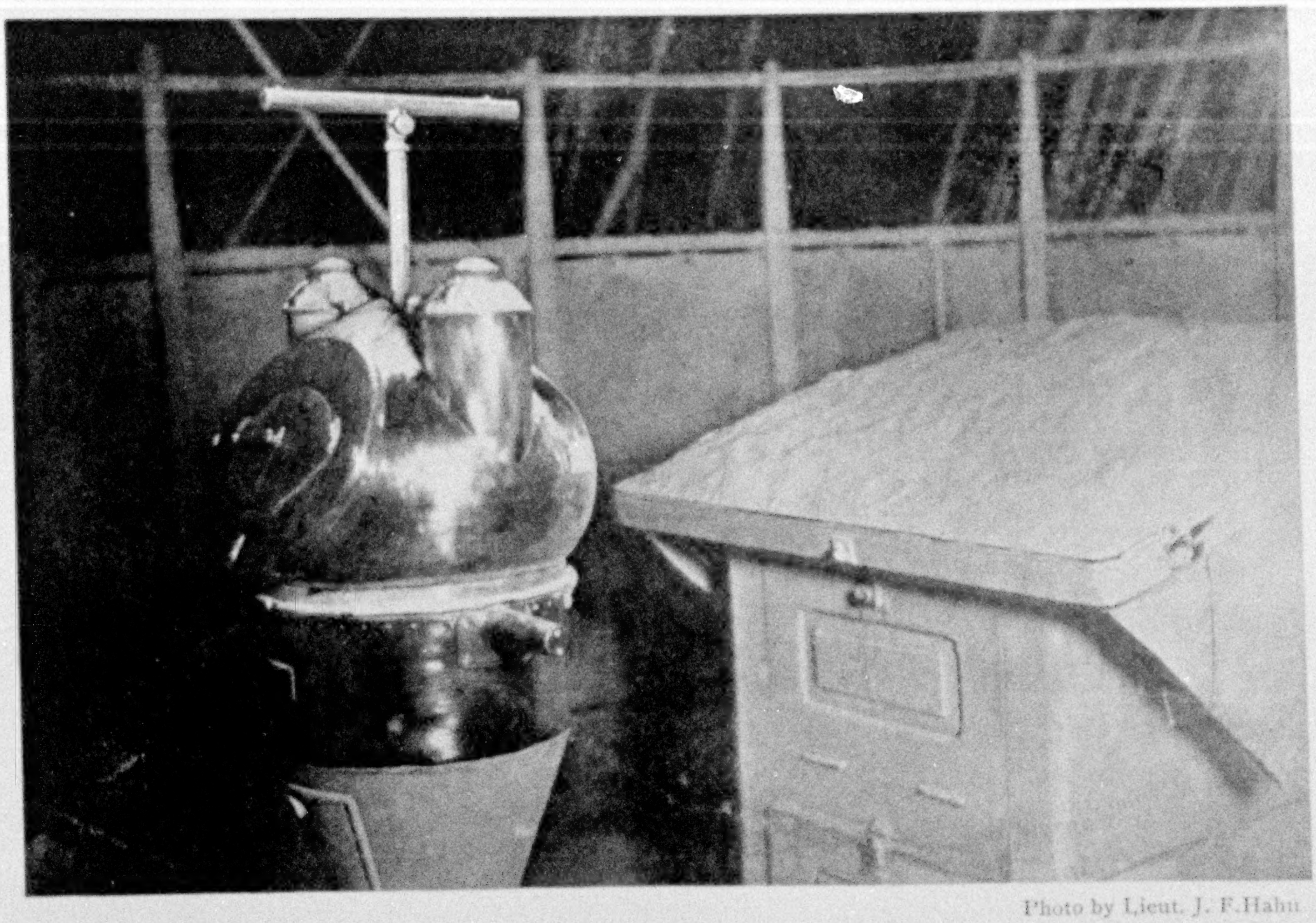


Photo by Lieut. J. F. Hahn

A FLASHLIGHT VIEW TAKEN UNDER THE OPEN SKY AT NOON, SHOWING ASH-COVERED CHART BOARD OF THE "MANNING," JUNE 8, 1912—100 MILES FROM VOLCANO

"The darkness was intense, and the ash so thick in the air that bright lights failed to penetrate it for more than a few feet. It is said that a lighted lantern held at arm's length could barely be seen, and that the searchlight of the *Manning* failed to penetrate farther than the bow of the ship" (see page 156).

couver Island and Puget Sound, 1,500 miles away.

In the violence of the explosion, in the quantity of material thrown out, and in the distance to which the ejected material and sound waves were carried, this was certainly among the greatest eruptions witnessed by man. It differs, however, from almost all other known great eruptions in that the immediate damage to property was almost nothing, and that, as far as known, it was not the direct and sole cause of the loss of a single human life.

HOW THE NEWS CAME

The stories which came by wire from the towns along the Alaska coast at this time told of an eruption of the first magnitude somewhere to the westward. These towns heard the explosion, felt the earth tremble, and saw the air clouded with dust brought in on the west wind. Still no authentic news came as to the exact origin of the disturbance. The volcano proclaimed its own news for a thousand miles down the coast, yet silenced the wireless by which the Alaska Peninsula and Kodiak Island were ordinarily in communication with the world.

The first detailed and authentic news came when the little old mail steamer *Dora*, notorious partaker in many a wild Alaskan episode, returned to Seward from her monthly Aleutian pilgrimage with her decks smeared with ashes and reported witnessing the outbreak from a near-by point and running out to sea in 24 hours of darkness and ashes. The *Dora* had been unable to reach Kodiak in the darkness caused by the volcanic cloud (see page 154).

It is highly probable that other vents in the vicinity of Mount Katmai had been steaming profusely throughout the summer, and they may at times have been in a moderate state of eruption, but all the available evidence indicates that

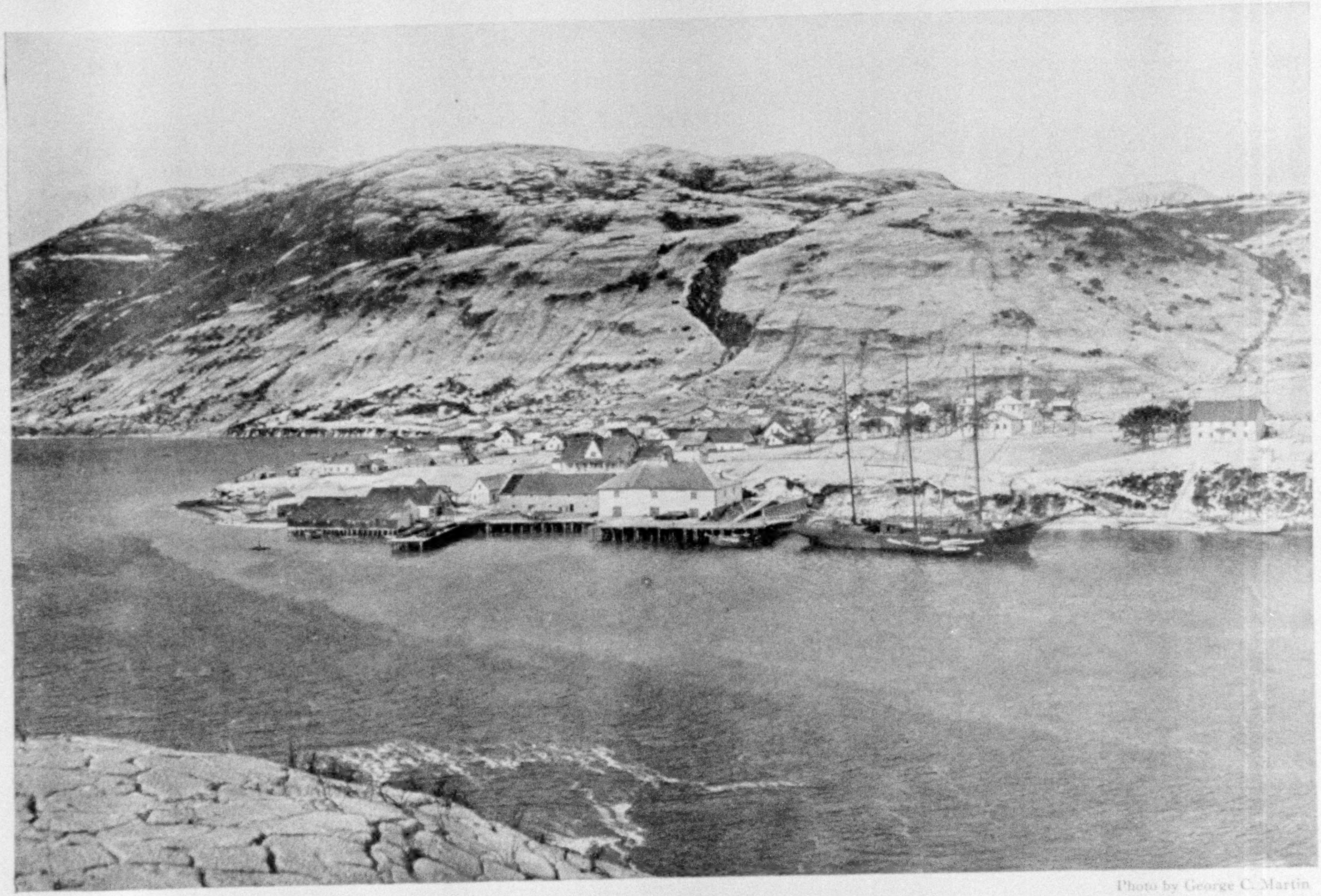


Photo by George C. Martin

THE TOWN OF KODIAK, ALASKA, AFTER THE ERUPTION OF KATMAI

The town is 100 miles from the volcano. Note the heavy deposits of white ashes covering hillsides and town. Dust fell as far away as Juneau, Ketchikan, and the Yukon Valley, distant 750, 900, and 600 miles from the volcano

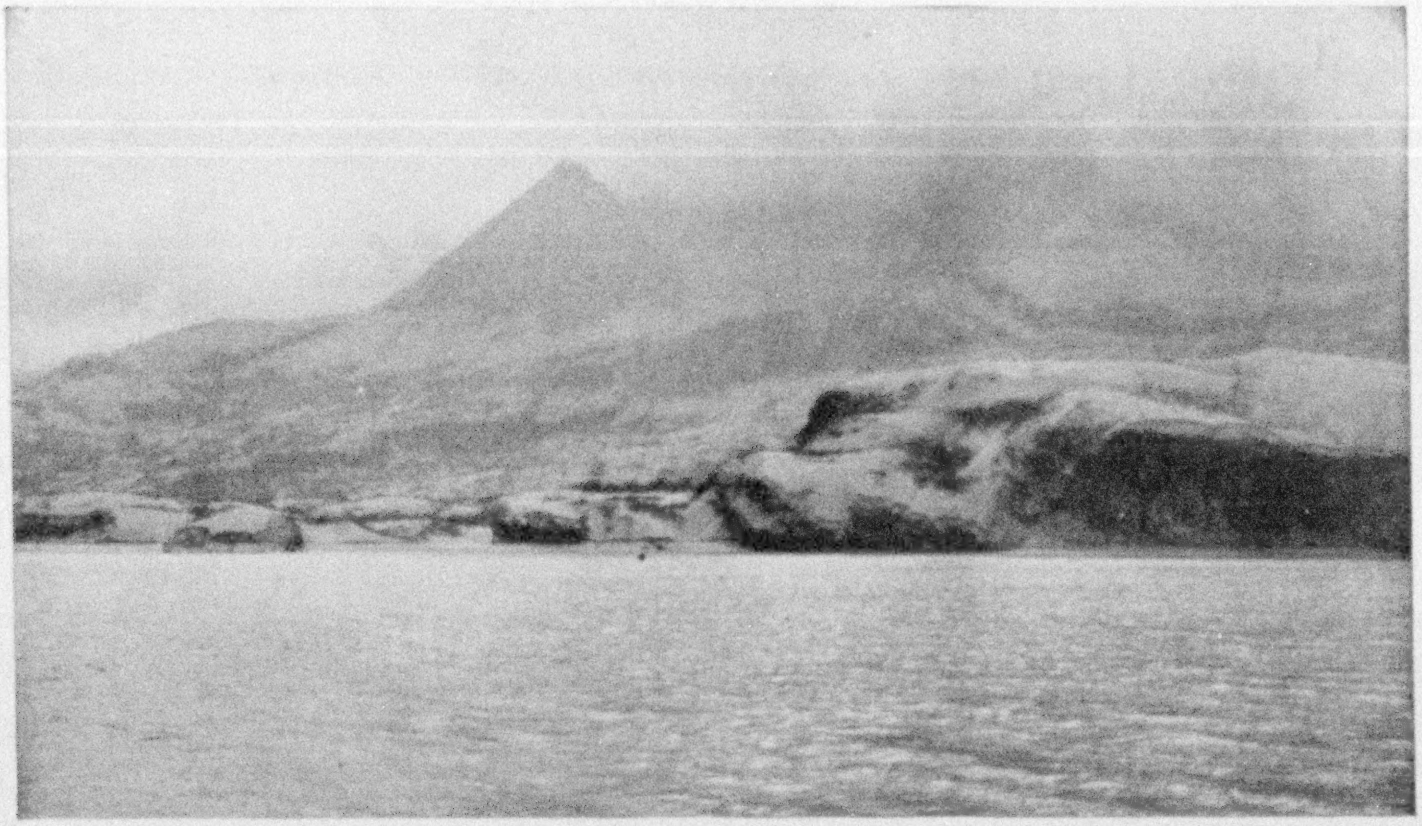


Photo by George C. Martin

VOLCANIC CLOUD POURING OVER MOUNTAIN WEST OF AMALIK BAY, 1.30 P. M., AUGUST 10, 1912

The white drifts which cover the mountain slopes are not snow, but ash and pumice from the volcano

Mount Katmai is by far the most active of the group, and is probably the only one which contributed in any large way to the great volume of solid matter ejected in June.

THE SCENE OF THE ERUPTION

Mount Katmai is a peak 7,500 feet high, situated relatively near the eastern end of the Alaska Peninsula and of the Aleutian Mountains.

The Alaska Peninsula is like a great horn, convex on the southern side, 500 miles in length, averaging 50 miles in width, and projecting southwestward from the Alaska mainland. It has a partly submerged extension in the Aleutian Islands which stretches 1,100 miles westward toward Asia, and with these separates Bering Sea from the Pacific.

The Aleutian range, like the less continuous line of peaks on the islands trailing from it, is dominantly volcanic throughout, there being certainly nine, and probably at least twelve active or latent volcanoes in the Alaska continental end of the belt. The Aleutian Islands probably contain a still larger number of volcanoes. Only two of the Alaska volcanoes, Wrangell and Edgecombe, are not situated in these groups (see page 136).

The mountains in this belt which have shown indications of volcanic activity in historic times include Redoubt, Iliamna, and St. Augustine, on Cook Inlet. Redoubt was active in January, 1902, while St. Augustine had an exceptionally violent eruption in October, 1883.

The easternmost volcano known on the Alaska Peninsula is Mount Kugak, which was probably active in 1889. Mount Katmai comes next to the westward, and has a near neighbor, Mount Mageik, which seems to have shared, in a more moderate way, its recent activity. There are probably other unnamed volcanoes in the near vicinity.

Veniaminof, near Chignik, was in eruption on August 28th, 1892, this outbreak apparently being, next to those of Katmai and of St. Augustine, the most violent known in Alaska. Farther west and near the extremity of the Alaska Peninsula is Mount Pavlof, which has been continuously steaming for many years.

The volcanoes of the Aleutian Islands include a well-known group at the eastern end in which are Isanotski, Shishaldin, Pogromni, Akutan, and Bogoslof,

MOUNT EDGECOMBE AND SITKA

The town of Sitka is historically the most notable settlement in Alaska. It was founded as Fort Archangel Gabriel by the Russians in 1799, about 6 miles from the present site, to which the move was made in 1804, and was transferred to the United States in 1867. The town and its inhabitants preserve many Russian characteristics, and it is still the see of a Russian orthodox bishop. Its climate is more equable than that of Ottawa and its annual temperature higher. Mount Edgecombe is a volcano 3,467 feet high.

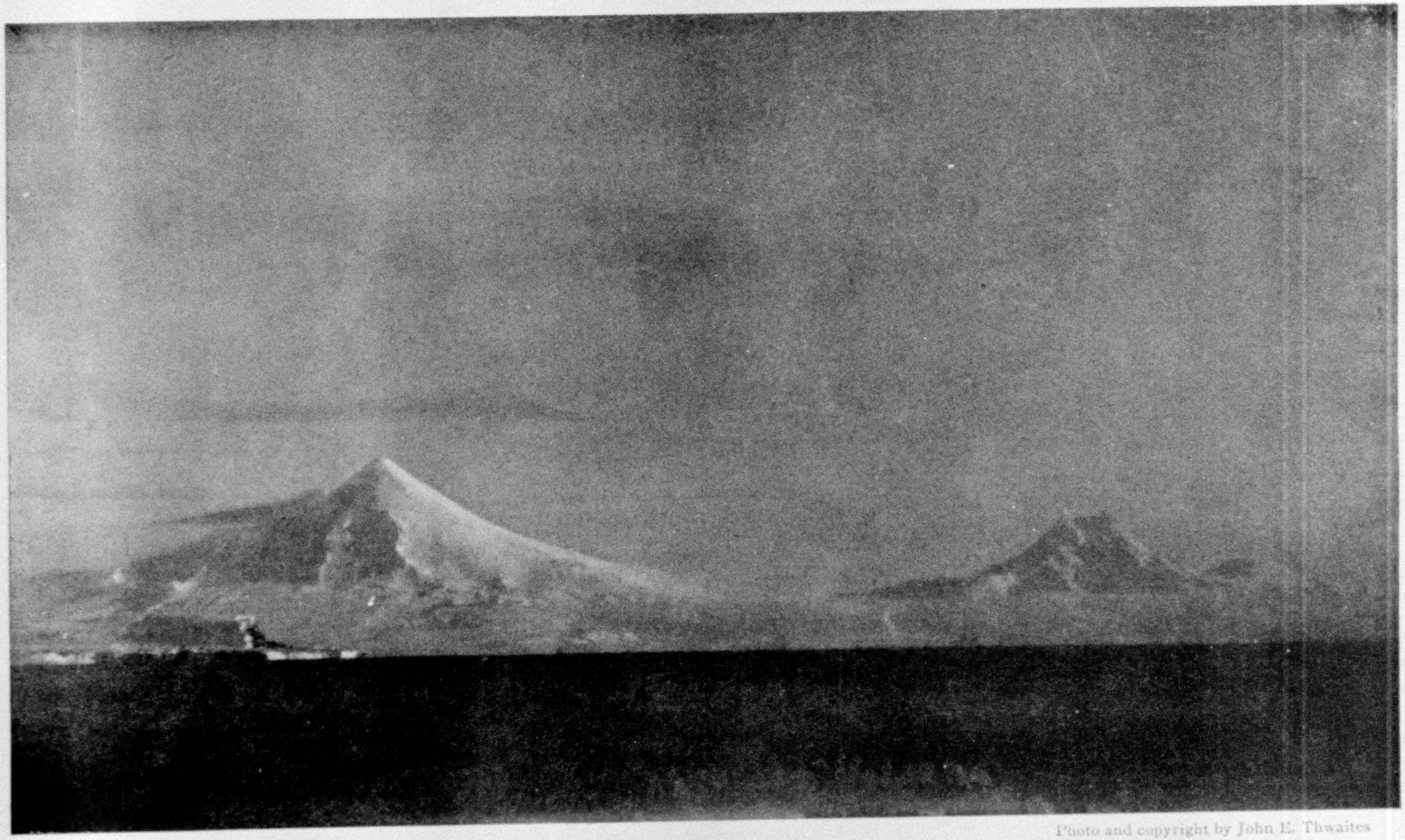


Photo and copyright by John E. Thwaites

SHISHALDIN VOLCANO, 9,387 FEET HIGH

This volcano is situated on the first of the series of islands which stretch out from the end of the Alaska Peninsula towards Asia across the Bering Sea. The volcanoes on these islands are exceedingly difficult to photograph, as this region is constantly enshrouded in thick fog or mist.

Photo and copyright by John E. Thwaites

THE BEAUTIFUL CONE OF PAVLOF VOLCANO

This active volcano stands at the head of a deep, land-locked bay near the western extremity of the Alaska Peninsula, at a distance of about 315 miles from Katmai

and a large number of others situated farther to the west.

Shelikof Strait, a turbulent and treacherous body of water, averaging 35 miles in width, lies south of the eastern end of the Alaska Peninsula and separates it from Kodiak and Afognak islands, which shared the effects of the eruption with the eastern end of the Alaska Peninsula. These islands are mountainous, but not volcanic.

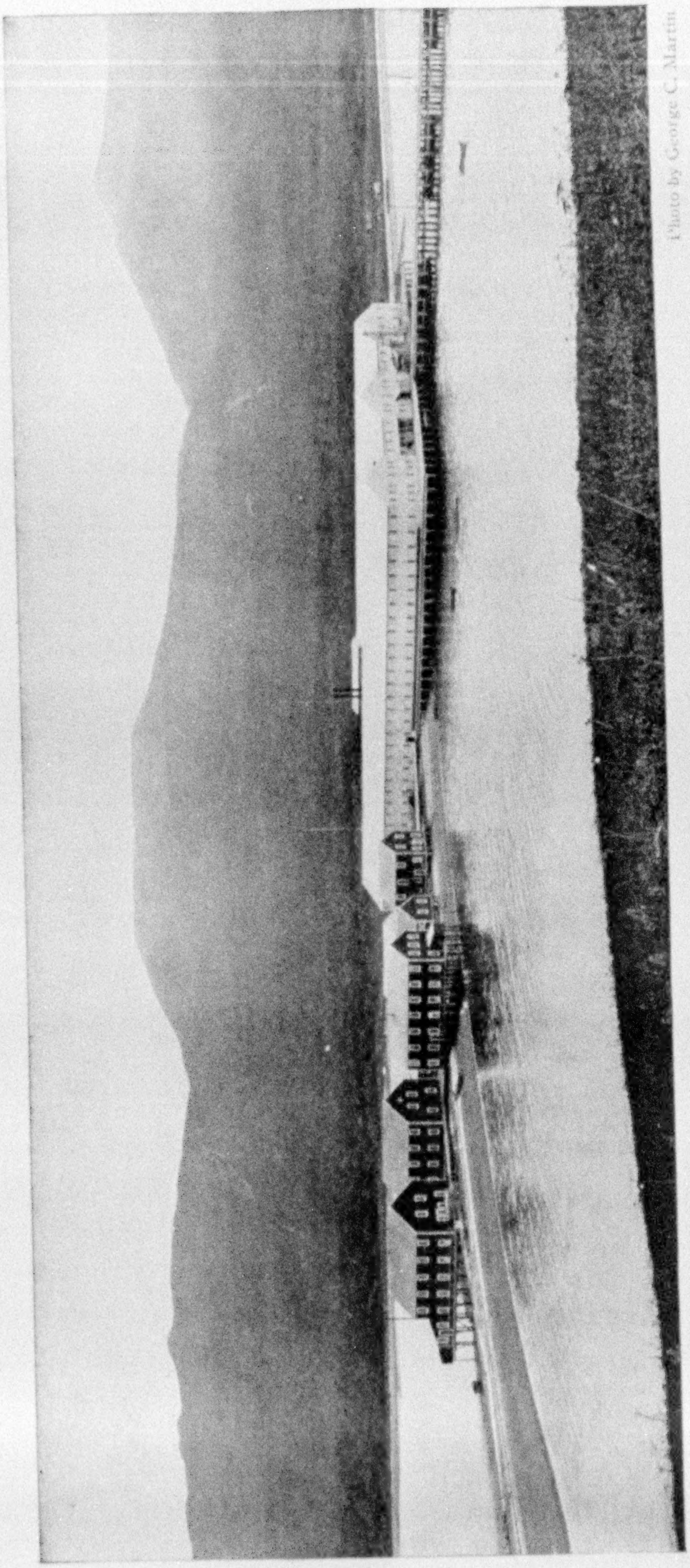


Photo by George C. Martin

CANNERY OF ALASKA PACKERS' ASSOCIATION AT LARSEN'S BAY, KODIAK ISLAND, AUGUST 23, 1912

A small amount of ash fell here, but the grass was not covered, and no serious damage was done except to the fish, which were frightened away

THE INHABITANTS OF THE ALASKA PENINSULA

The inhabitants of the Alaska Peninsula include a few hundred people in ten or twelve small native villages, the employés of four or five salmon canneries, and a handful of traders and prospectors. Most of the native villages had a former basis of prosperity in sea-otter hunting, but with the practical extinction of the sea otter this is gone and the salmon is the chief means of support.

The inhabitants of Kodiak and Afognak islands are mostly descendants of Russians. The largest settlements are Kodiak (St. Paul) and Afognak. The former is well known as one of the quaintest and most attractive towns on the Alaskan coast. Its population includes the largest proportion of Americans of any

XUM

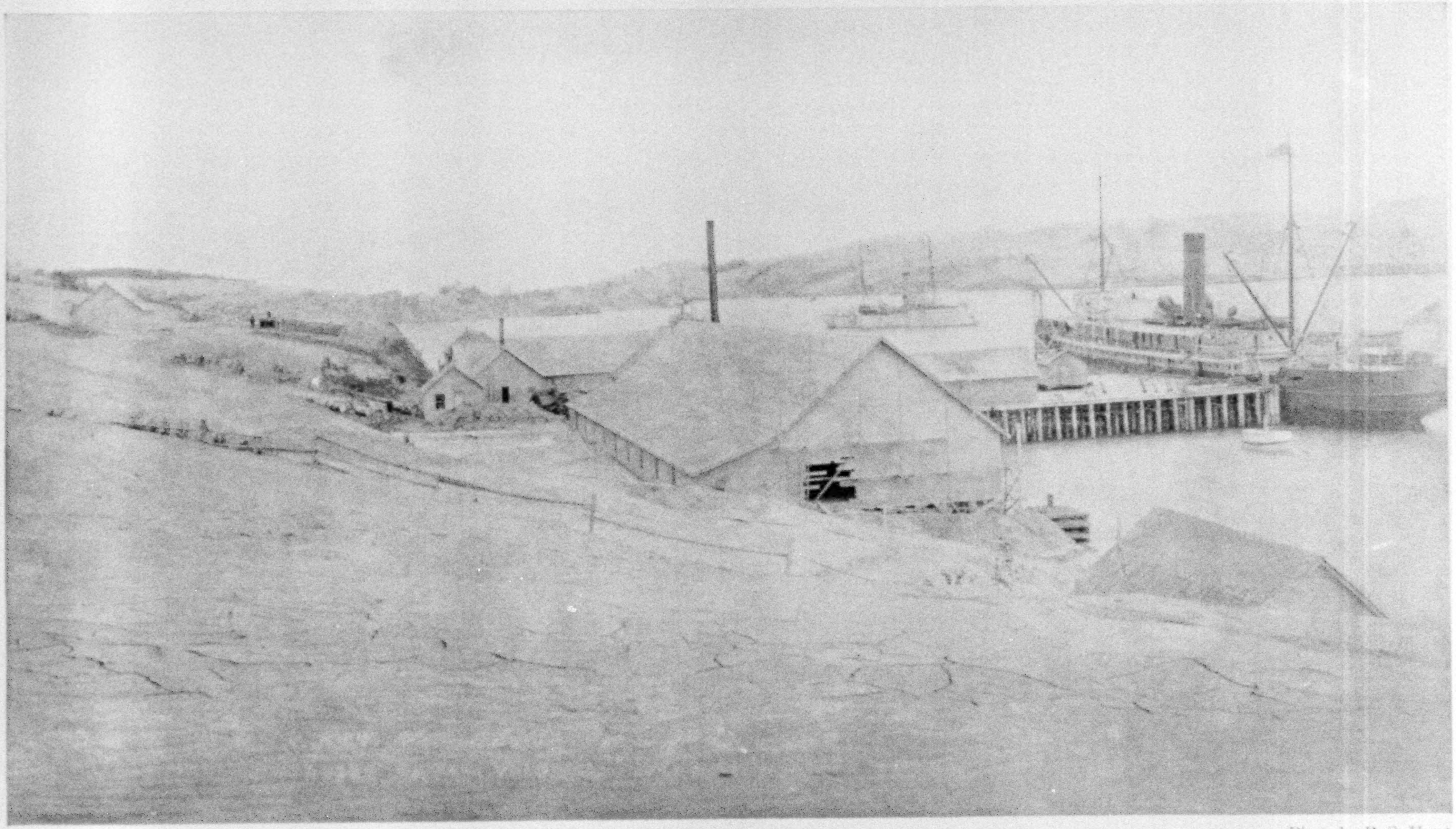


Photo by P. S. Hunt

KODIAK FISHERIES CANNERY, COVERED WITH 10 INCHES OF ASH FROM KATMAI VOLCANO, WHICH IS 100 MILES AWAY

town in southwestern Alaska. The town had long lived upon the memories of its former glories as capital during the early Russian occupation and of the prosperous sea-otter days. New activities have recently come through the establishment of salmon and halibut fisheries and of important agricultural industries.

It was the sparse settlement of the district which alone prevented great loss of life during the recent eruption.

The town of Katmai was deserted at the time of the eruption, most of the inhabitants being at Kaflia Bay, 30 miles east of the volcano.

THE NATIONAL GEOGRAPHIC SOCIETY'S INVESTIGATION

As soon as it became known that there had certainly been a great eruption in southwestern Alaska the Research Committee of the National Geographic Society made plans for the investigations upon which this article is based. This expedition is the beginning of a systematic study of the Alaskan volcanoes which the National Geographic Society has in view and which will be carried out by some experienced authority on volcanism. The writer was selected for this first expedition not as a student of volcanism, but as one who eight years before, in the course of the U. S. Geological Survey's investigations, had made a cruise of 300 miles in an open boat along this little-known coast, and was consequently somewhat familiar with the local geographic details.

A hurried departure from Washington, a busy day of outfitting in Seattle, and a leisurely voyage of 13 days past all the windings of the sinuous southern coast-line of Alaska preceded an arrival in Kodiak just four weeks after the eruption began. The protracted voyage from Seattle had its compensation in that it permitted visits to many places which had been affected by the eruption and interviews with many eye-witnesses.

On reaching Kodiak it was found that the revenue cutter *Manning* was still in port and was about to move the refugees from the uninhabitable mainland villages to a new location west of the affected zone. Capt. K. W. Perry kindly welcomed the writer as a passenger on this and following cruises of the *Manning*. The four weeks spent aboard the *Manning* permitted the obtaining of vivid accounts of the hours of darkness which the officers of the cutter witnessed at Kodiak, and of their subsequent observations in the vicinity of the volcano and elsewhere, and also gave opportunity to see parts of the coast which would otherwise have been inaccessible.

After leaving the *Manning*, the power schooner *Lina K.* was chartered and cruises were made along the southeast shore of Afognak Island and the northwest shore of Kodiak Island, the effects of the eruption being thus studied in detail. While in Shelikof Strait watch was kept for a glimpse of the volcano, but the clouds hung continuously upon the mountain.

On August 8 the clouds seemed breaking and the sea was smooth, so we crossed to Amalik Bay on the mainland. Vast columns of steam could be seen rising through the clouds, but the latter were not dispelled enough to permit a satisfactory view. Two weeks were spent on the mainland between Amalik and Cold bays. During this time many interesting phenomena, described below, were observed, but the glimpse of the volcano itself, which was desired most of all, was not obtained.

The part of Alaska in which Mount Katmai is situated and the districts most seriously affected by the eruption are so thinly settled that the number of persons who observed the eruption and its larger effect is comparatively small. The writer has been able to get in touch directly or indirectly with most of these people, and they have furnished information of very great value which could not otherwise have been obtained.

CONDITIONS PRECEDING THE ERUPTION

Mount Katmai had been in a dormant condition for an unknown length of time, but for many months prior to its outburst it must have been going through the changes which a dormant volcano always undergoes prior to an eruption.

A volcano consists of a vent extending from the surface of the earth to a

Photo by George C. Martin

CHURCH AND GRAVEYARD AT DOUGLAS VILLAGE, JULY 14, 1912: NOTE THE BEACH GRASS GROWING UP THROUGH CRACKS IN 11 INCHES OF ASH

reservoir of molten material deep in the earth's crust. The vent usually reaches the surface at the summit of a mountain, composed of material thrown out in earlier eruptions and terminates above in the opening known as the crater. When the volcano is not in eruption this vent is closed by material fallen in from above and by material which was not fully expelled during preceding eruptions and solidified there.

WHAT CAUSES AN ERUPTION

An eruption is preceded by a long continuing and gradually increasing accumulation of pressure from the reservoir of molten material. The eruption is caused by this pressure becoming at last sufficient to overcome the resistance of the material which chokes the vent, or by a sudden relief of pressure by faulting or some other cause. The conditions preceding the eruption include a gradual rise of lava in the vent, accompanied by an increase in the temperature of the surface rocks, an increase in both temperature and volume of the waters and gases given out, and by earthquakes and minor explosions.

The initial outburst is accompanied by the final clearing of the vent and breaking up and expulsion of the detritus and solidified lava by which it had been closed and sometimes by the destruction of the mountain. This suddenly relieves the underlying liquid lava of an enormous pressure, and results in the rapid giving off of the steam and other gases which the lava contained.

Hot molten lava, especially when under pressure, has the capacity to dissolve great volumes of gas. It is in the condition of water under pressure and charged with gas. The uncorking of the volcano has therefore the same effect as the uncorking of a bottle of any other liquid charged with gas; the gas rushes out, carrying part of the liquid material, chiefly in the form of coarse spray.

It is this frothing of the lava which creates pumice, which is nothing but lava blown full of holes and projected in a liquid condition into the air, where it cools. The explosion which began is then continued in great force with the ejection of a stream of lava-spray or liquid pumice, which is kept up as long as the imprisoned gases last.

This action is usually intermittent, the volcano behaving somewhat as a geyser and being subject to the effects of repeated accumulation and sudden release of pressure from below. In most cases, after the larger part of the gas is given off, the lava flows quietly out in response to the pressure back of it.

HOW SHOWERS OF ASHES ARE FORMED

The column of steam and lava-spray, after being blown out of the crater, expands until it is in so rarefied a condition that it floats freely in the air and is known as volcanic smoke. This gradually cools, and in so doing becomes unable to support the solid particles which gradually fall in a shower of ash and dust. These finer materials are composed chiefly of the smaller particles of spray as they solidified, together with detrital material made up of fragments broken from the walls of the crater by the passing blast, and of pumice dust made by the larger pieces breaking as they struck each other or cracking as they cooled.

The eruption of Mount Katmai was doubtless preceded by the conditions described above, yet in this case, probably because of the absence of near-by observers, none of them except the earthquakes were recorded. Earthquakes were felt at Katmai for at least five days prior to the eruption, while more severe shocks were felt on June 4 and 5 at Kanatak, Uyak, and Nushagak. These places are 65, 58, and 130 miles from Mount Katmai to the southwest, southeast, and northwest respectively.

It seems highly probable that the volcano began to throw out large volumes of gases on the 5th, since observers at Cold Bay noted that the northern sky in the direction of the volcano "looked black and storming" late that night, in spite of the fact that there was fair weather on the coast.

THE EXPLOSIONS THAT WERE HEARD 900 MILES AWAY

Early in the afternoon of June 6 the volcano passed into a state of violent eruption. There must have been fre-

Photo by George C. Martin

BARABARAS AT DOUGLAS VILLAGE, JULY 14, 1912

A barabara is the name given by the Aleuts to their huts, which are built half underground and roofed with soil. Those shown in the picture were almost buried beneath the tremendous shower of ashes from Katmai

Photo by George C. Martin

INTERIOR OF MAIN ROOM OF BARABARA AT DOUGLAS VILLAGE, SHOWING HOW THE ASH PENETRATED THE CREVICES AND CRACKS

quent explosions accompanied by earthquakes during the morning, but few of these were intense enough to be noticed at a distance. It was only at Seldovia and Nushagak that these preliminary morning explosions were noted.

The beginning of the violent phase of the eruption was apparently at 1 p. m., June 6, at which time a terrific explosion and earthquake was noted by C. L. Boudry at Cold Bay (see page 147). At the same hour a heavy cloud was seen from the steamer *Dora* (55 miles away) rising over Mount Katmai. This cloud was under observation from this time until it enveloped the steamer, 5½ hours later. The accompanying views of the cloud were taken by John E. Thwaites, mail clerk of the *Dora*, just before darkness shut down (see pages 154, 155).

At 3 p. m. there was a tremendous explosion, which was heard for hundreds of miles around, and the volcano passed into a state of continuous eruption, which lasted, except for possible short intervals, for several days.

This explosion was noted at Uyak, at Iliamna Bay, at several places on Iliamna and Clark lakes, at Koggiung, and at a point 90 miles southwest of Eagle. Explosions were also heard at about this time, although no statement of the exact hour is available, at Juneau, 750 miles east, and Fairbanks, 500 miles northeast of the volcano. At Iliamna Bay the sounds were accompanied by a "sudden, quick motion of the clouds that would start and stop."

It was probably at this time that the larger part of the coarse, gray ash which forms the lower stratum on the Alaska Peninsula and on Kodiak and Afognak islands was thrown in the air. This ash reached Uyak, 58 miles away, at 3.30 p. m., and Kodiak, 100 miles from the volcano, at 5 p. m., and soon afterward complete darkness settled down over an area of several thousand square miles.

Photo by George C. Martin

KATMAI VILLAGE, LOOKING NORTH TOWARD KATMAI VOLCANO, WHICH IS CONCEALED IN THE CLOUD BEYOND THE HILLS
AUGUST 13, 1912

The eruption of Katmai Volcano, though one of the most violent explosions recorded, did not cause the loss of a single life, owing to the sparse settlement of the neighborhood. The town of Katmai was deserted at the time of the eruption, most of the inhabitants being away, engaged in the summer fishing.

EYE-WITNESSES OF THE ERUPTION

The only people who witnessed the explosion from near at hand were natives. Two families, who stayed at Katmai after the other people of that town went away to work in a fishing camp, left Katmai for Cold Bay on June 4, and were in camp on the shore between Kamvik and Alinchak bays at the time of the eruption.

C. L. Boudry, who was at Cold Bay when these people reached there wrote in his diary: "They report the Katmy hill blew up and threw rock out to sea, but could not tel mor as they whare on the road to Cold Bay—an that pommey stone in fire whas falling 20 miles an that the watter was hot in the Katmy bay—after examining ther boat ther i found pummice stone the sise of common rice."

Jack Lee, who also interviewed them on their arrival at Cold Bay wrote: "They report the top of Katma Mountain blun of. There was a lot of Pummy stone in their dory when they got here and the say Hot Rock was flying all eraund them."

These last two statements of the interviews with the natives are quoted verbatim because each contains an assertion that the explosion wrecked the mountain. In this connection it is important to note the statement made by William Neilson, of Iliamna, as quoted in a letter from Thomas W. Hanmore. Mr. Hanmore says: "While Mr. Neilson was in Naknek" (he went there June 7, and was there at least until June 9) "the natives from the Indian village of Savanoski, at the head of Naknek Lake, came to Naknek very much excited. They reported the upper half of Katmai Mountain gone and the mountain burning up."

These people, together with those from Katmai, were the nearest persons to the volcano at the time of the eruption, and were in an excellent position to observe what happened. Proper allowance must, of course, be made for the natural but unintentional exaggeration due to the excitement of the moment; but the close similarity of these entirely independent accounts, their source from people who, though familiar with dormant volcanoes, certainly never before witnessed a violent eruption, and their agreement with what we would expect to happen in an eruption of this character, all confirm them as being probably reliable and accurate descriptions of what occurred at 3 p. m., June 6, as seen by the only eye-witnesses.

THE SECOND EXPLOSION

The activity of the volcano probably slackened somewhat after the severe outbreak at 3 p. m. The next violent explosion was probably at about 11 p. m. that night, at which time a hard earthquake was noted at Cold Bay and at about which time a strong glare of light was observed at Kanatak (see page 148).

It is believed to be the ash of this eruption which began falling at Kodiak about noon of June 7, at Afognak at 4 p. m. of the same day, and at the west end of the Kenai Peninsula early the morning of the 8th. This shower continued without interruption at Kodiak for 26 hours, or until 2.30 p. m., June 8. The ash which fell during this shower is the second stratum of fine brown material 4½ inches thick at Kodiak after being packed down.

The people at Cold Bay apparently first realized that a volcano was in violent eruption on the morning of June 7. The westerly wind on the 6th kept any ash from reaching Cold Bay, and apparently neither the earthquakes nor the black cloud in the northern sky had been considered as having any connection with the long dormant volcanoes. By the morning of the 7th the continued and increasing noise of thunder and explosions, together with the growing violence of the earthquakes, called closer attention to the appearance of the cloud, which had then risen to a great altitude and assumed a well-marked form and other characteristics which made it impossible to confuse it with an ordinary storm-cloud.

Father Patelin, who was at Kanatak, noted that the smoke came and dust fell there the morning of June 7, though the wind continued to be from the west. There were earthquakes nearly all day, with short intervals between. Many of

the earthquakes were strong and there was continuous rumbling. The earthquakes became so severe toward evening that it seemed dangerous to remain in the barabaras, one of which nearly fell in, so they were abandoned and tents used. That evening after 10 o'clock came the strongest earthquake yet felt, accompanied by heavy rumbling and rock-slides from all around. There was evidently a strong glare of light from the volcano, it being recorded that "the mountains were like sunshine." After midnight he heard a "big noise like thunder from the Katmai side," after which everything was quiet and he slept.

THE THIRD EXPLOSION

It is important to note the very severe earthquake which was felt at Cold Bay at 10.40 p. m. June 7, and also at Kanatak at about the same hour. At Kanatak heavy rumbling was heard and an intense flare of light came from the direction of the volcano. Earthquakes lasted all this night at Iliamna Bay (115 miles distant from Katmai Volcano), it being recorded that "the earth never ceased to move for nearly 12 hours." Earthquakes were reported from 90 miles southwest of Eagle at 11 p. m. June 6 or 7. It is evident that these phenomena marked another violent outbreak of the volcano. Probably it was the material erupted during this period which forms the uppermost stratum at Kodiak and vicinity, falling there during the night of June 8.

The period of explosive activity and of the ejection of large quantities of solid matter seems to have ceased on June 8, the volcano then passing into a less violent but freely erupting stage which lasted all summer and possibly still continues. An immense column of steam was noted rising from the volcano wherever the absence of clouds permitted a view in that direction. Frequent earthquakes were noted on the Alaska Peninsula at intervals throughout the summer; heavy rumblings were heard by all who approached the vicinity; so-called flames were observed from Bristol Bay; fumes were noted at long distances from the mountain, and occasional light showers of ashes fell as far away as Nushagak. These subsequent phenomena will be described more fully after we have considered the conditions existing during the fall of ash from the eruptions already described.

THE ZONE OF DARKNESS AND FALL OF ASHES

The material hurled into the air by the explosions described above ascended to great heights and traveled east under the influence of the prevailing wind in a succession of clouds. The coarser material began to fall at once, but so great was the total volume of material that the clouds traveled several hundred miles before very considerable amounts of dust had ceased to fall and before they ceased to spread absolute darkness over the land and sea. The track of the clouds seems to have been to the east over the southeast end of Kodiak Island and out to the sea for an unknown distance, then back under the influence of a wind shifting into the east, so that Cook Inlet, Iliamna Lake, and Bristol Bay received a belated shower. The influence of the west wind at the time of the eruption on the distribution of ash is shown by the fact that the total amount of ash which fell at Cold Bay, only 50 miles from the volcano, was less than that which fell at Seldovia, 150 miles away, and probably was little if any more than that which fell at Juneau, which is 750 miles distant.

The nearest to the volcano of those within the zone of darkness were the natives in a fishing camp at Kaflia Bay. Ivan Orloff, the creole Tyone of Afognak, who was with these people, wrote as follows to his wife:

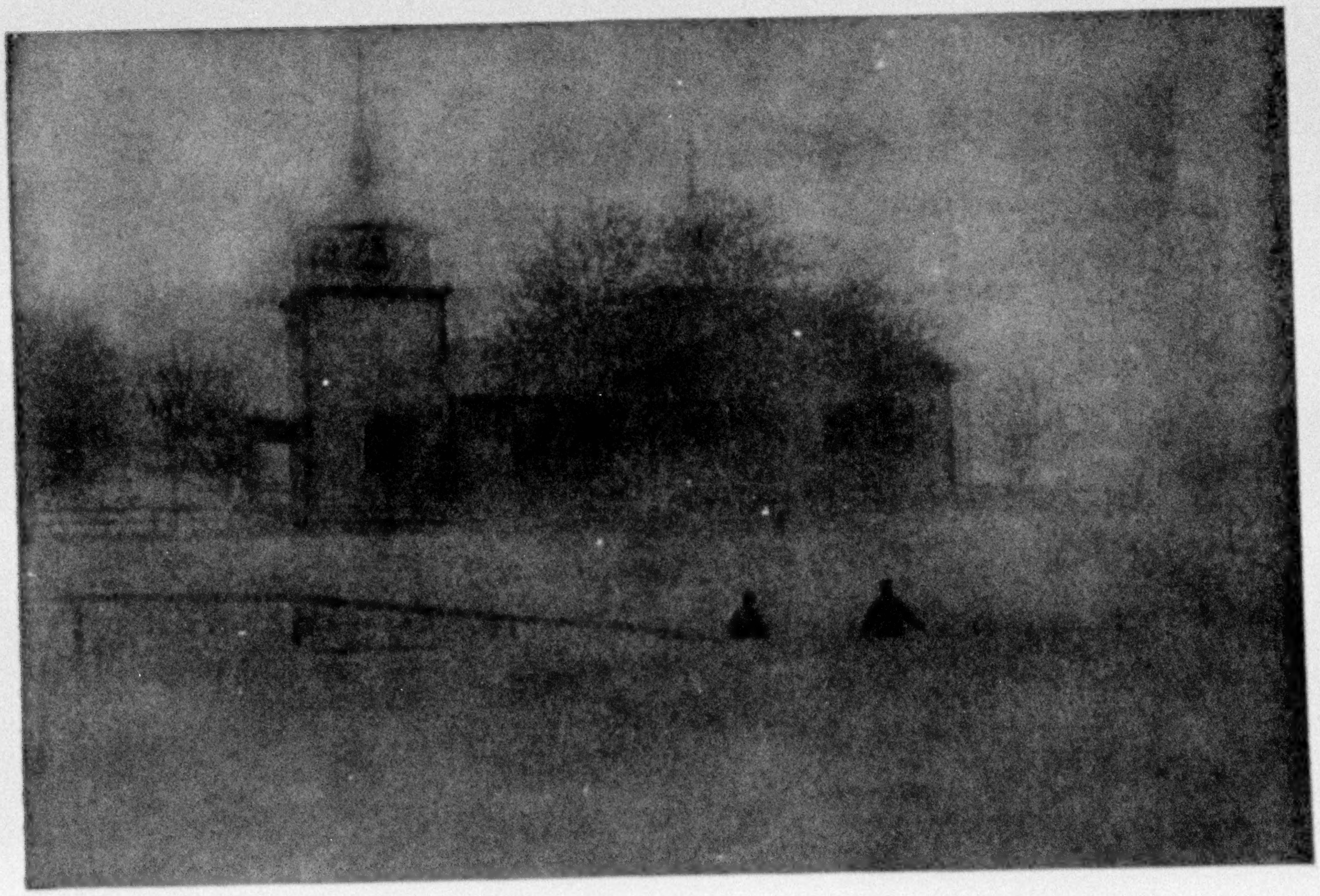
KAFLIA BAY, *June* 9, 1912.

MY DEAR WIFE TANIA:

First of all I will let you know of our unlucky voyage. I do not know whether we shall be either alive or well. We are awaiting death at any moment. Of course do not be alarmed. A mountain has burst near here, so that we are covered with ashes, in some places 10 feet and 6 feet deep. All this began on the 6th of June. Night and day we light lamps. We cannot see the daylight. In a word, it is terrible, and we are expecting death at any moment, and we have no water. All the rivers are covered with ashes. Just ashes mixed with water. Here are darkness and hell, thunder and noise. I do not know whether it is day

Photo by John E. Thwaites

NATIVE CHURCH AT KODIAK BEFORE THE ERUPTION OF MOUNT KATMAI



THE SAME SCENE DURING THE ERUPTION OF MOUNT KATMAI, JUNE 6, 1912, SHOWING THE GREAT DRIFTS OF VOLCANIC ASHES

XUM

LAST SEA-OTTER HUNT, UNGA

BIDARKA IN ILIAMNA BAY

These bidarkas are used in the pursuit of otters. They vary from 18 to 25 feet in length and are very light, being constructed of hides stretched over a slight wooden framework. They can be very rapidly propelled and are constructed to carry one to three people with never more than three paddles.

Photo by George C. Martin

RUSSIAN CHURCH AND INHABITANTS OF LITTLE AFOGNAK, JULY 30, 1912

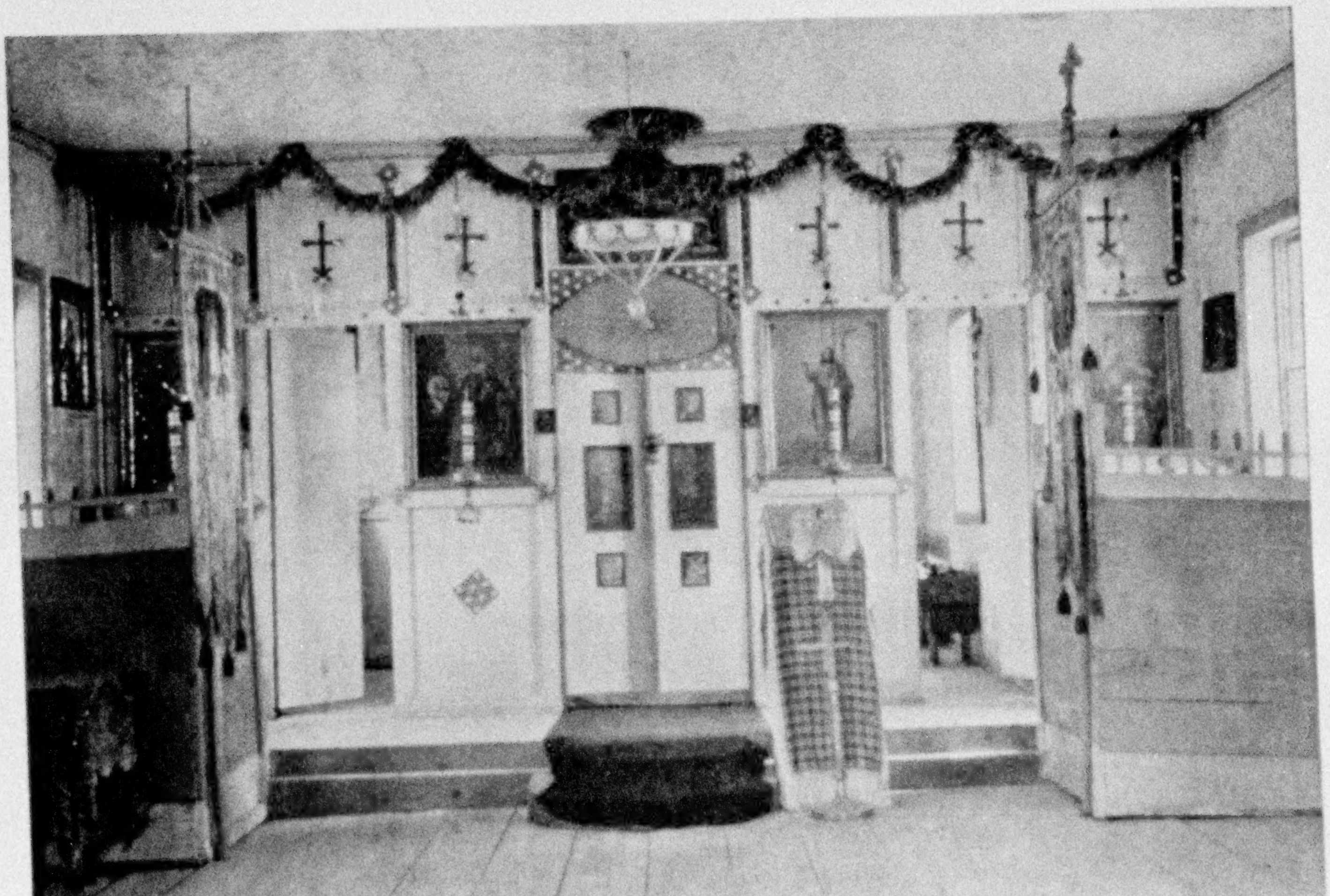


Photo by George C. Martin

THE INTERIOR OF THE RUSSIAN CHURCH AT LITTLE AFOGNAK, JULY 30, 1912

The inhabitants of Little Afognak are mainly descendants of Russian settlers and belong to the Orthodox Church

or night. Vanka will tell you all about it. So kissing and blessing you both, good-bye. Forgive me. Perhaps we shall see each other again. God is merciful. Pray for us.

Your husband, IVAN ORLOFF.

The earth is trembling; it lightens every minute. It is terrible. We are praying.

WHAT WAS SEEN FROM A PASSING STEAMER

The outburst on the afternoon of June 6 was witnessed from the steamer *Dora*, which was then passing through Shelikof and Kupreanof straits, eastbound. Capt. C. B. McMullen, of the *Dora*, has given the following description of the phenomena which he observed:

"Left Uyak at 8.45 a. m., June 6; strong westerly breeze and fine clear weather. At 1 o'clock p. m., while entering Kupreanof Straits, sighted a heavy cloud of smoke directly astern, raising from the Alaska Peninsula. I took bearings of same, which I made out to be Katmai Volcano, distance about 55 miles away. The smoke arose and spread in the sky, following the vessel, and by 3 p. m. was directly over us, having traveled at the rate of 20 miles an hour.

"At 6 p. m. passed through Uzinka Narrows, fine and clear ahead, and continued on expecting to make Kodiak. At 6.30 p. m., when off Spruce Rock, which is about 3½ miles from Mill Bay Rocks and the entrance to Kodiak, ashes commenced to fall and in a few minutes we were in complete darkness, *not even the water over the ship's side could be seen.*

"I continued on in hopes that I might pick up entrance to Kodiak, but when vessel had run the distance by the log conditions were the same, so I decided to head out to sea and get clear of all danger. At 7.22 I set a course NE. by N. (magnetic). Wind commenced to increase rapidly now from the southwest and vessel was driven before it. Heavy thunder and lightning commenced early in the afternoon and continued through the night. Birds of all species kept falling on the deck in a helpless condition. The temperature rose owing to the heat of the volcanic ash, the latter permeating into all parts of the ship, even down into the engine-room.

"About 4.30 a. m. next day vessel cleared the black smoke, emerging into a fiery red haze, which turned into yellow, and by 6 a. m. the ashes had ceased to fall and the horizon was perfectly clear from west to north.

"The wind now came from the northwest and vessel was headed for Chugach Islands, as the smoke and ash was still in the sky astern of us.

"During the day Katmai continued to be emitting volumes of smoke and could be seen at a distance of over 100 miles.

"The vessel was covered with ash from trucks to deck, the decks having ashes from 4 to 6 inches deep.

"Made Seldovia June 7 at 8 p. m. and Homer at 11 p. m. Leaving Homer at 11.30 p. m., proceeded on toward Seward. At 3.30 to 4 a. m. passed through bank of volcanic ash. At 7 a. m. vessel was in complete darkness again and I dropped the anchor near Clam Bay until 9.20; clearing a little, proceeded again and run out to sea. At 10 a. m. complete darkness again, which continued throughout the day until 4 p. m., when we ran out of the smoke area into brilliantly clear weather."

THE RAIN OF ASHES

John E. Thwaites, mail clerk on the *Dora*, was quoted in a local paper as saying that at 1 p. m. an immense column of smoke was seen ascending from the westward, its diameter seeming to be at least half a mile or a mile. The column rapidly became dimmer, and a dark mass of cloud showed above it, mingled with it, and came toward the steamer. Soon the cloud obscured the column altogether, and afterward lightning was seen in the cloud. At 4 p. m. the edge of the cloud was directly overhead and the pictures were taken (see pages 154, 155).

As the sun passed behind the edge of the cloud at this time, it immediately began to grow dark. At 5 o'clock lights were turned on. At 6 o'clock the advance edge of the cloud was out of sight beyond the horizon, and small white flakes began to fall. Darkness gradually increased as the streak of clear sky in the northwest narrowed, until "when the last ribbon of clear sky was suddenly ob-

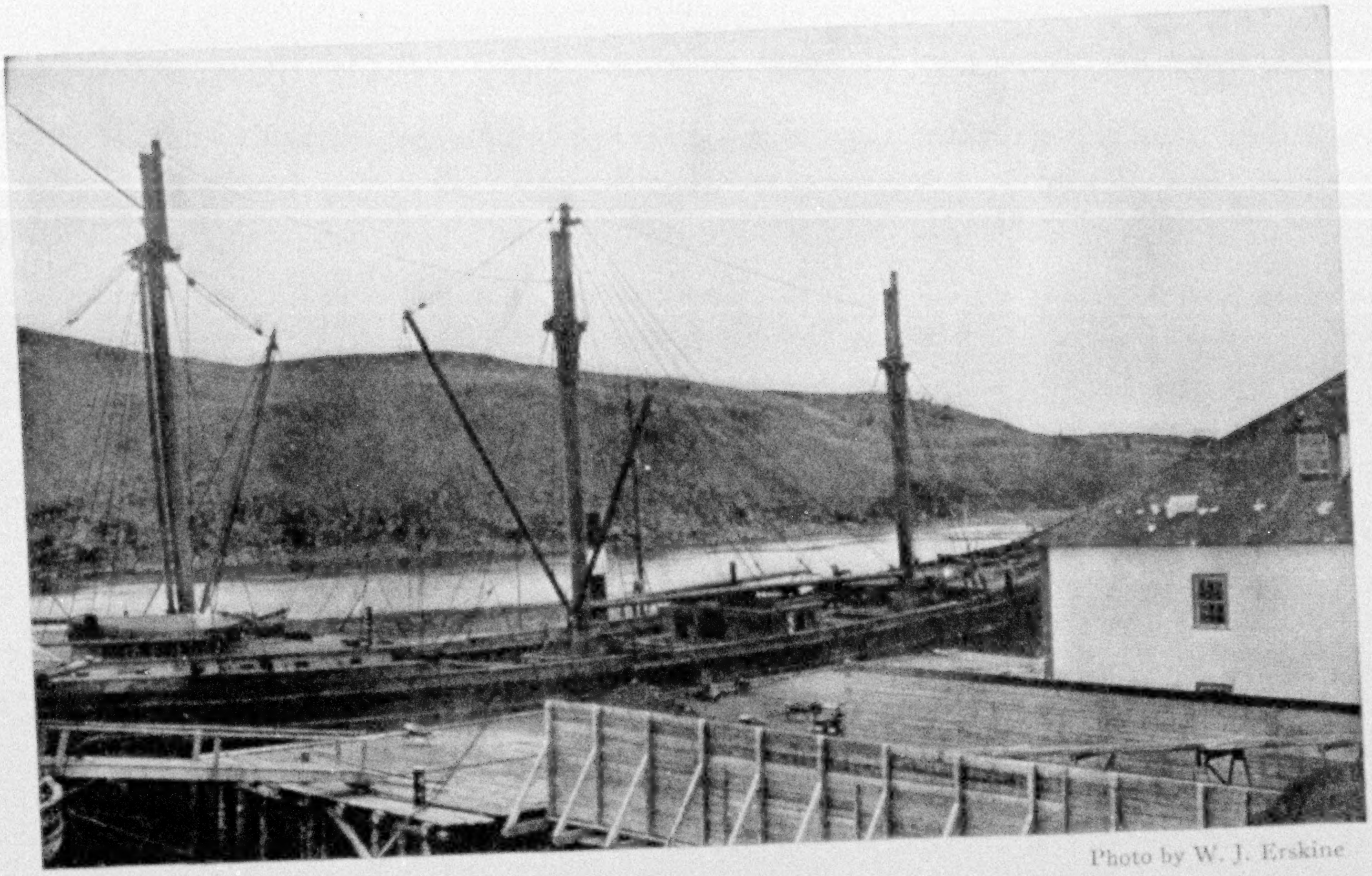


Photo by W. J. Erskine

BARGE "ST. JAMES" AT KODIAK, JUNE 4, 1912, BEFORE THE ASH FALL

Photo by W. J. Erskine

THE "ST. JAMES" AT KODIAK, JUNE 9, 1912, AFTER THE ASH FALL

"The buildings of the Navy wireless station, on Wood Island, were struck by lightning and burned on the evening of the 7th or the morning of the 8th. The darkness at the time was so intense that the flames could not be seen from the mission, less than ¼ mile away. Late in the afternoon of June 8 partial daylight appeared and the fall of ash almost ceased" (see page 156). There was darkness for practically 60 hours, at a distance of 100 miles from Katmai Volcano (see page 165).

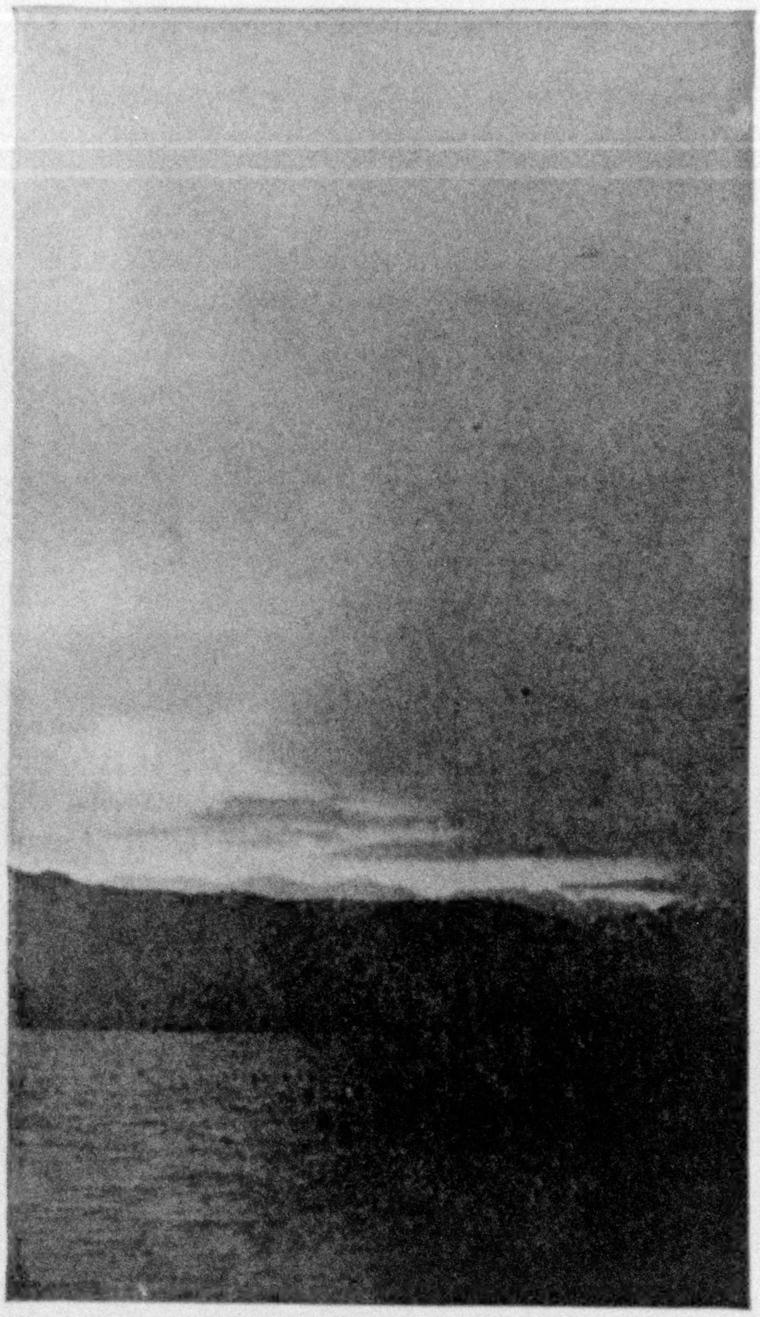


Photo and copyright by John E. Thwaites

EDGE OF VOLCANIC CLOUD, LOOKING SOUTHWEST FROM THE "DORA," 75 MILES FROM VOLCANO (SEE PAGE 133)

scured, the light snuffed out like a candle and we were left in absolute darkness."

Mr. Thwaites' further statement of conditions during the darkness and fall of ashes on night of June 6, as published in the *Seward Gateway* of June 15, is as follows:

"And now began the real rain of ashes; it fell in torrents; it swirled and eddied. Gravity seemed to have nothing to do with the course of its fall. The under side of the decks seemed to catch as much ashes as the sides or the decks under our feet. Bright clusters of electric light could be seen but a few feet away, and we had to feel our way about the deck. The officers of the deck had to close the windows of the pilot-house tightly, and even then it was with the greatest difficulty that the man at the wheel could see the compass, through the thick dust that filled the room. In the meantime, lurid flashes of lightning glared continuously round the ship, while a constant boom of thunder, sometimes coinciding with the flash, increased the horror of the inferno raging about us. As far as seeing or hearing the water, or anything pertaining to earth, we might as well have been miles above the surface of the water. And still we knew the sun was more than two hours above the horizon.

"In the saloon everything was white with a thick layer of dust, while a thick haze filled the air. The temperature raised rapidly, and the air, what there was left of it, became heavy, sultry, and stifling. Below deck conditions were unbearable, while on deck it was worse still. Dust filled our nostrils, sifted down our backs, and smote the eye like a dash of acid. Birds floundered, crying wildly, through space and fell helpless to the deck."

BLACKNESS OF NIGHT AT MIDDAY

The events at Kodiak during the eruption, including the appearance of the black volcanic clouds, the rain of ashes, the 60 hours of almost continual darkness, the precautions taken for the safety of the people, and the welcome return of clear skies, have already been vividly described in these pages by Captain Perry, of the revenue cutter *Manning*,* and will not be repeated in detail here.

The volcanic clouds were first noticed about 4 p. m., June 6, in the south and west. Another cloud afterward appeared in the north, the two meeting in the northeast. Ash began to fall at 5 p. m., coming in gradually increasing volume. At 7 p. m. complete darkness had shut down. Thunder and lightning were observed soon after the cloud appeared, and

*(See NATIONAL GEOGRAPHIC MAGAZINE, vol. XXIII, No. 8, pp. 824-832.)

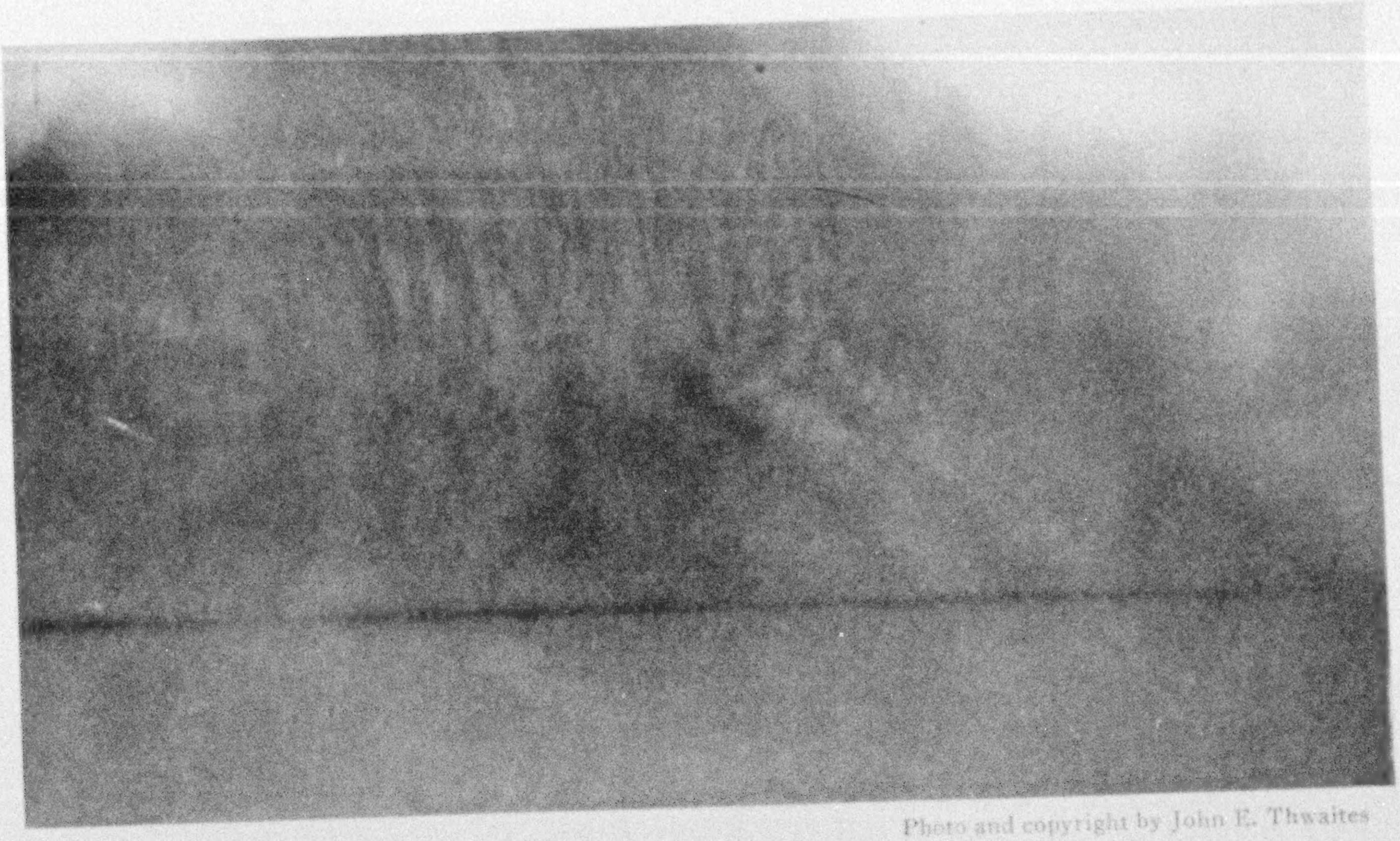


Photo and copyright by John E. Thwaites

VOLCANIC ASH APPROACHING KODIAK ISLAND

Photograph taken straight up from deck of the *Dora*, June 6, 1912

Photo and copyright by John E. Thwaites

SMOKE FROM KATMAI VOLCANO AS IT PASSED OVER KODIAK ISLAND

Photograph taken straight up from deck of the *Dora* June 6, 1912

"The column rapidly became dimmer, and a dark mass of cloud showed above it, mingled with it, and came toward the steamer. Soon the cloud obscured the column altogether, and afterward lightning was seen in the cloud. . . . As the sun passed behind the edge of the cloud at this time, it immediately began to grow dark. . . . 'The last ribbon of clear sky was suddenly obscured, the light snuffed out like a candle, and we were left in absolute darkness.'" (see pages 152, 154).

Photo by H. C. Hermann

ON BOARD THE "MANNING" AT KODIAK, JUNE 8, 1912

continued in great severity throughout the rain of volcanic material, but diminished in intensity after midnight of the 6th.

The lightning was described by one observer as traveling like a snake and in some cases as going up from the earth in round balls. Electrical conditions were such that wireless apparatus could not be used. A number of severe earthquakes were felt during the night.

Ash fell continuously until 9.10 a. m., June 7, but in decreasing volume after 3 a. m. The total fall of ash up to this time was originally about 5 inches, but packed down afterward to 4 inches, forming the lower and coarse gray stratum now on the ground (see page 166).

THICK DARKNESS AND A RAIN OF ASHES FOR OVER 25 HOURS

At noon, June 7, the fall of ash was renewed. At 1 p. m. darkness came again, not to be dispelled until after 2.30 p. m. of the following day. During all this time the fall of ash was continuous and was accompanied at times by sulphurous fumes. *The darkness was intense, and the ash so thick in the air that bright lights failed to penetrate it for more than a few feet.* It is said that a lighted lantern held at arms length could barely be seen, and that the searchlight of the *Manning* failed to penetrate farther than the bow of the ship. By the morning of the 8th the ash had accumulated in sufficient bulk on the steep hillsides to begin sliding in great volumes.

The buildings of the Navy wireless station on Wood Island were struck by lightning and burned on the evening of the 7th or the morning of the 8th. The darkness at the time was so intense that the flames could not be seen from the mission, less than ¼ mile away. Late in the afternoon of June 8 partial daylight appeared and the fall of ash almost ceased. The ash which fell during this

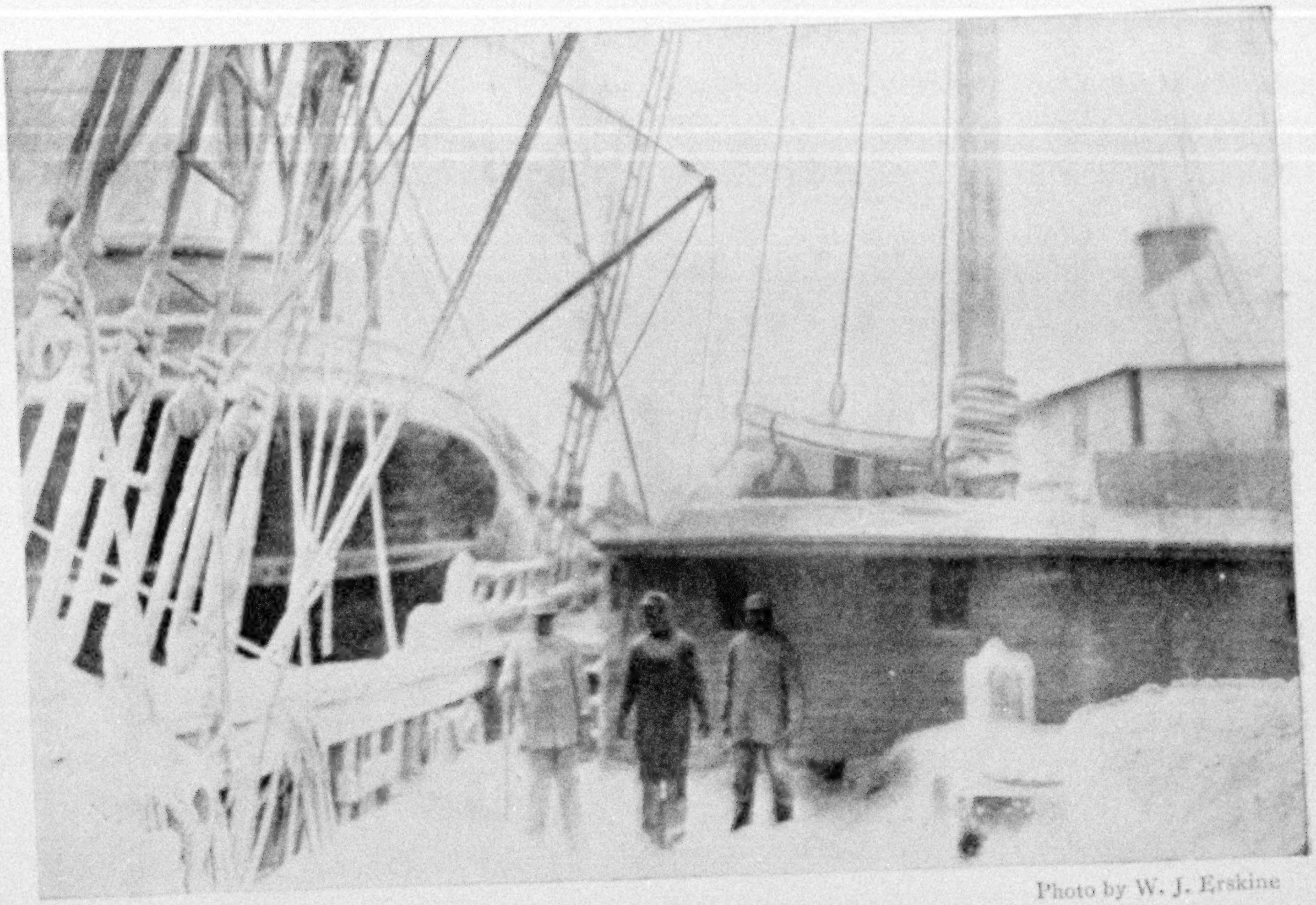


Photo by W. J. Erskine

THE END OF THE ASH FALL AT KODIAK: SCHOONER "METHA NELSON" AND BARGE "ST. JAMES," JUNE 9, 1912

time constitutes the second stratum, now 4½ inches thick, of fine-grained brown material.

During the evening of June 8 the fall of ash was again resumed and continued until an unrecorded hour in the night, when it gradually diminished, entirely ceasing by the morning of the 9th, when daylight appeared. The ash which fell during this interval is the third stratum, composed of 1½ inches of very fine-grained, light-gray material.

Conditions as observed at Afognak by E. M. Ball differ in few essentials from those already described at Kodiak. The time of the appearance of the cloud is not recorded. It is, however, described as approaching in silence, there being no wind on the level of the ground and no thunder and lightning.

The ash reached the west end of Kenai Peninsula early in the morning of June 7, slight showers being reported at Port Graham at 3 a. m., and at Seldovia, 150 miles from Katmai volcano, at about the same time. Explosions and earthquakes had been noted since 9 a. m., June 6, becoming louder and more frequent throughout the day. The sky was overcast all day June 7, but there was no darkness, and comparatively small amounts of ash fell. The more heavily ash-laden clouds were at this time passing eastward, further south.

Boats on Cook Inlet reported lightning rising from the water in the direction of Barren Islands. Explosions and earthquakes were observed throughout the day. The next day there was a much heavier fall of ash, and there was moderate darkness for two hours during the forenoon. Frequent and violent earthquakes and explosions were noted. A dense cloud of dust came slowly in from the south about 3 a. m., June 9.

Ash fell from 5 a. m. till nearly noon, and inky darkness prevailed during part of this time. (This place is 150 miles from the Katmai volcano.) The fall of ash was much heavier than on the preceding day, about ¾ inch accumulating on the ground, and sulphur fumes accompanied its fall. Explosions were heard at irregular intervals on the 9th and con-

tinued in decreasing violence and frequency until the 14th. The last ash was recorded as falling on the 13th.

EXTENT OF THE CLOUD OF ASHES

The ash cloud reached the eastern end of Prince William Sound, 375 miles northeast of the volcano, about noon of June 7, at which time the log of the steamer *Bertha* records that the sun turned red in a clear sky, the air became hazy, and dust began falling. Cannonading at irregular intervals was heard aboard the steamer at 2 a. m., June 8, at Cordova. The Whiteshead wireless station reported at this time that the noises had already been heard there for 36 hours. There was a light westerly breeze when the dust first came, but after the steamer passed Cape Hinchenbrook the wind came from the east, but the fall of ash increased, continuing until the steamer reached Juneau, at 8 p. m., June 10. The heaviest fall was east of Cape St. Elias, in a fresh easterly breeze.

Dust fell at Katalla (410 miles from Katmai volcano) 48 hours after the first explosions, which sounded like discharges of dynamite in the near-by hills. The ash came first on a southwest, but afterward on an east, wind. For about three days the air was so thick that one could see only a mile or two. There was no darkness, and only about ¼ inch of ash fell. Vegetation was turned yellow.

The steamer *Admiral Sampson* also reported that ash fell all the way from Seldovia to Juneau. The air was so thick that one could not see more than 2 miles until passing Cape Spencer. Brass tarnished in 15 or 20 minutes after being polished.

It was reported in the press that dust fell in Ketchikan (900 miles from Katmai) June 8, and in Vancouver and Victoria June 11.

Dust fell 90 miles southwest of Eagle the morning of the 10th, and was reported from Dawson on the 11th. It fell also in small but appreciable quantities at Fairbanks, Ruby, and in the Innoko district.

SUBSEQUENT EVENTS

The freely erupting condition of the volcano, which appears to date from the cessation of the continuous violent explosions and of the ejection of large volumes of ashes, etc., about the 8th of June, continued until at least the last week in August. The exact conditions during this time are not known, but it is evident that violent earthquakes occurred frequently; that the crater or craters sent forth vast and probably continuous clouds of vapor, and that at times considerable dust was ejected.

At Cold Bay (50 miles from Katmai Volcano), where complete daily records were kept from June 6 to August 15, earthquakes were recorded on 50 of the 70 days from June 8 till August 15. They were heaviest on the following dates: June 8, 11, 13, 17, 21, 22, 28, July 4, 16, 21, 23, 24, 30, and 31. The most severe ones were noted on June 11, 21, and July 30.

Sounds, probably of volcanic explosions, were heard at Cold Bay on June 17, 22, 28, July 9, 16, and August 13.

The presence of fumes and falling dust at Cold Bay was influenced largely by the direction and intensity of the wind. Fumes were noted almost continually from June 8 till July 5, from July 12 till July 24, and on July 30 and 31, and August 10 to 12. They were strongest on June 8 to 11, 17, 23, 24, and August 5. A general decrease in their intensity is thus shown. Dust was prevalent in the air until June 24, falling in sufficient amount to be seen upon the ground on June 10, 13, 17, 21, and 24.

The times at which columns of steam and other visible evidence of conditions at the volcano could be seen from Cold Bay depended chiefly, if not wholly, upon weather conditions, and are consequently of little significance other than indicating that they were probably always present.

The glare of volcanic light upon the steam and clouds was observed on June 23 and July 21 and 31. This phenomenon could be seen only during favorable weather conditions, so its apparent absence at other times is not significant.

Some of the phenomena observed at Cold Bay were of widespread occurrence:

On the morning of June 9 observers at Naknek, 80 miles northwest of the volcano, saw a beautiful illuminated fun-

Photo by W. J. Erskine

THE END OF THE ASH FALL AT KODIAK

Photo by W. J. Erskine

A PORCH WHICH COLLAPSED BENEATH THE WEIGHT OF THE ASHES

Many of the houses at Kodiak were wrecked by the weight of ashes which descended in avalanches from the hillside. In other cases the roofs collapsed under the weight of ashes, for the deposits were frequently as much as 24 inches in thickness.

XUM

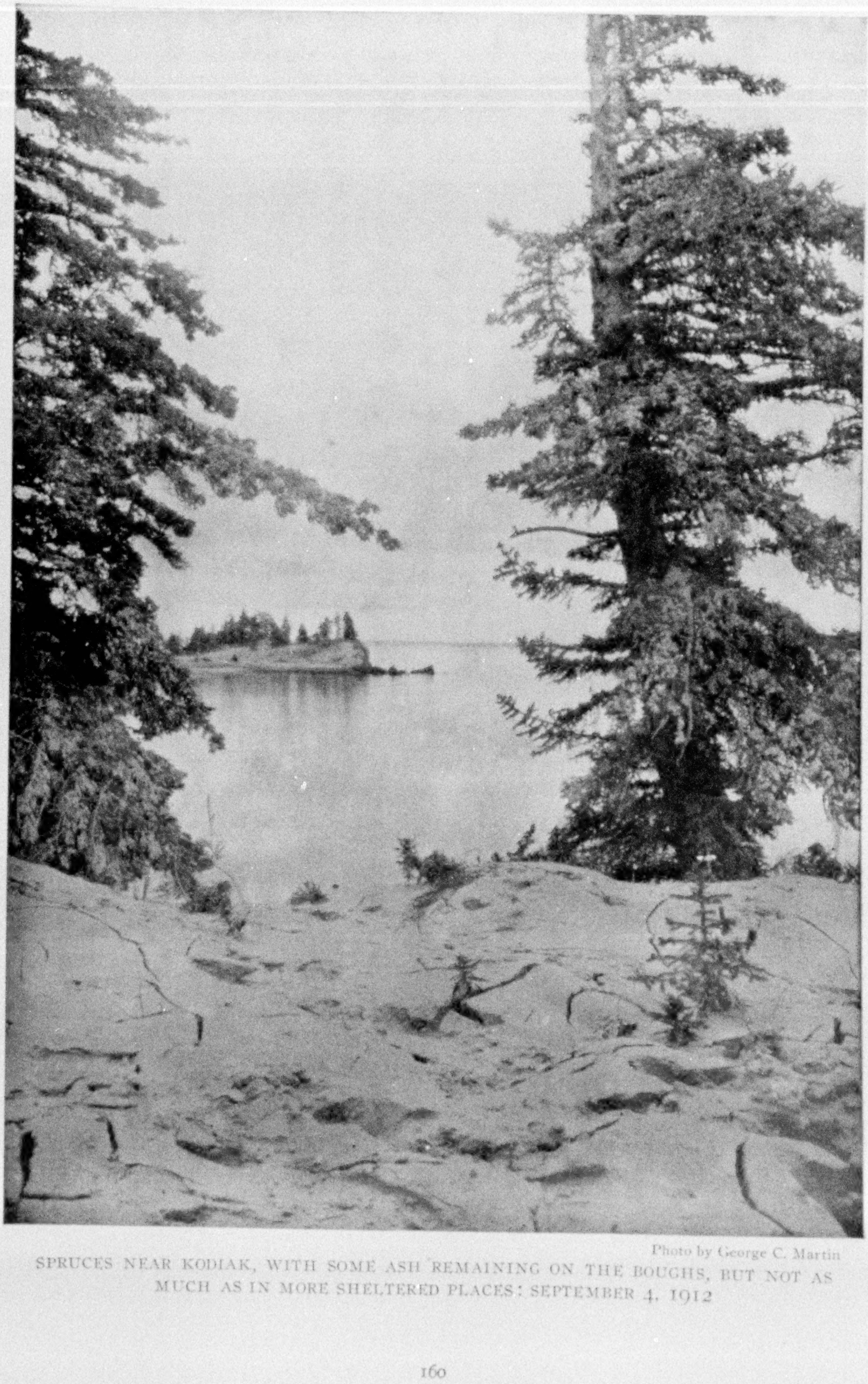


Photo by George C. Martin

SPRUCES NEAR KODIAK, WITH SOME ASH REMAINING ON THE BOUGHS, BUT NOT AS MUCH AS IN MORE SHELTERED PLACES: SEPTEMBER 4, 1912

nel-shaped cloud, which rose straight into the air to a considerable altitude, and, as there was no wind, retained its shape. It afterward assumed different colors and dissolved into cloud banks, being illuminated all the time. A similar cloud was observed from Iliamna, 115 miles north-northeast of the volcano and 135 miles from Naknek, at the same time, the description differing from the above only in the statement that in losing its funnel-shape form it assumed "the shape of a ship."

A severe earthquake was felt in the Yukon Valley and Alaska Range on July 6, the after effects continuing for about a week. It was apparently not felt in southwestern Alaska, and it is very doubtful whether it has any connection with the volcanic disturbance, as it was apparently central to the north of Mount McKinley.

Strong sulphurous fumes were reported by several on board the *Manning* from 6 to 9 a.m., July 27, when south of Marmot Island and about 120 miles east of the volcano. The author did not notice the fumes, but they were of sufficient strength to darken the new white-lead paint on the *Manning* and in Kodiak.

An immense column of steam ascending through the ordinary clouds in the position of Mount Katmai was seen by the writer during the evening of August 12 from Takli Island. While anchored here we heard almost continuous roar as of waterfalls or of surf on the islands, but no such surf was seen. Possibly the sound came from landslides in the ash, but more likely from the volcano.

THE RAIN THAT TARNISHED SILVER

On August 15 the writer was at the mouth of Katmai River. The wind was from the west and the sky was clear much of the day, except for cloud caps on the mountains.

The hills from west (magnetic) around through the north to the east (magnetic) of Katmai village were enveloped in a blue haze, which became denser throughout the morning. At noon the haze became so thick that the end of the ridge north of the Steamboat Bay Valley and the low hill 2 miles northwest of Katmai village were invisible from our anchorage, a mile above the mouth of the river.

Rain fell during the middle of the morning. The drops of water striking the eyes produced a sharp pain, and brass and silver were tarnished by the drops. The blue haze was thickest about noon and came nearer with the stronger wind, receding as the wind lightened. About 1 p. m. it became oppressively sultry, an apparent glare of heat being noted from the north. No sounds attributable to the volcanoes could be heard, nor were earthquakes felt. Photographs were taken, showing the edge of the haze on the end of the ridge west (magnetic) of our anchorage. No clouds over the volcanoes could be seen on account of the haze.

On August 16 sulphurous fumes were noted by H. M. Eakin at the Ophir Creek mines, 350 miles north of the volcano.

On August 17 earthquakes were felt at Naknek. They were so violent as to upset lamps on the table. Reports either of thunder or explosions were also heard.

COMPARISON WITH OTHER ERUPTIONS

The magnitude of a volcanic eruption is not properly measured by the loss of life and damage to property which it caused, for these are the accidental results of the eruption and are due largely to the chance proximity of cities. It is rather to be measured in terms of the natural phenomena; the quantity and distribution of the ejected material, the distance at which sound waves, dust, darkness, and fumes were observed, the violence of the accompanying earthquakes, the distribution and intensity of the resulting atmospheric conditions, and other natural phenomena of various kinds.

The greatest eruptions on record, measured by criteria of these kinds, include those of Krakatoa in 1883, Coseguina in 1835, Tomboro in 1815, Skaptar-Jökull in 1783, and Papandayang in 1772. The eruption of Katmai was apparently of a magnitude comparable with some of these (see article by Dr. Abbot in this number).

Comparing the eruption of Katmai with that of Krakatoa, in Sunda Strait between Java and Sumatra, in 1883, we

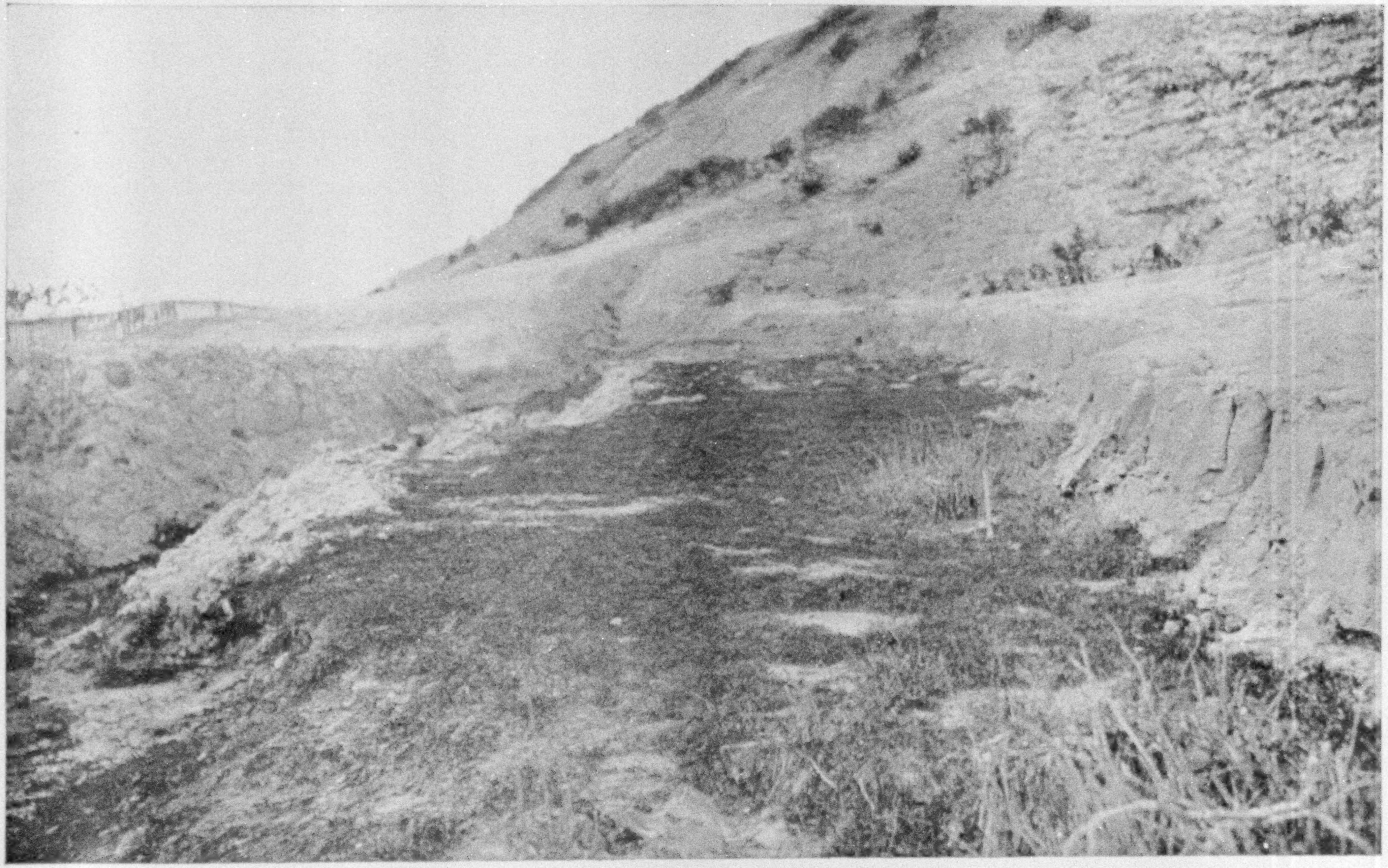


Photo by George C. Martin

GREAT ACCUMULATIONS OF ASH THAT HAD SLID DOWN THE STEEP HILLSIDES NEAR KODIAK, JULY 16, 1912

A small stream is fast removing this accumulation, having already exposed the grass in the foreground. Same gulch as shown on page 163

Photo by George C. Martin

These huge accumulations of ash, all of which had been carried from Katmai Volcano 100 miles away by the wind, give one some conception of the enormous amount of material which the volcano cast into the air in June, 1912. This is the same gulch as shown on page 162, but higher up.

Photo by W. J. Erskine

ASH ON THE TREES NEAR KODIAK, JUNE 24, 1912

"The finer dust stuck to the trees, especially to the spruces, causing a wintry-looking scene which lasted all summer. This fine dust does not wash or shake off readily, and probably will cling to the more sheltered spruces for many years" (see page 178)

find the volumes of ejected materials are not far from equal, but the explosive violence of the Krakatoa eruption was by far the greater. The explosions of Krakatoa were heard at a distance of 3,000 miles; those of Katmai were not recorded farther away than Juneau, a distance of 750 miles. But it should be noted that the country east of Juneau is chiefly an uninhabited wilderness, from which sounds are not likely to be reported, and that the more distant reports of sounds from Krakatoa came from islands and sailing vessels, both of which were more numerous in the Indian than in the North Pacific Ocean.

Darkness was recorded at a distance of 276 miles from Krakatoa and only at 150 miles from Katmai. The darkness lasted, however, only 22 hours at a distance of 133 miles and for 57 hours at a distance of 49 miles from Krakatoa, while there was darkness for practically 60 hours at a distance of 100 miles from Katmai.

The ash from Krakatoa fell to a depth of 18 inches in 24 hours at a distance of 66 miles, while the depth of the ash from Katmai was about 12 inches at a distance of 100 miles. (See also article by C. G. Abbot, page 191, in this number.)

The dust from Krakatoa fell at least 1,800, and possibly 3,300, miles away; that from Katmai has not been recorded authentically farther than Ketchikan, 900 miles away, but probably fell in small amounts at a distance of 1,200 or 1,500 miles. Here again it must be noted that the direction of heaviest ash fall from Katmai extended into the wilderness of British Columbia, where its maximum extent is difficult to recognize.

It is probably fair to conclude that the eruptions of Krakatoa and Katmai were of approximately equal magnitude, the former exceeding in the brief intensity of its culminating explosion, the latter in sustained violence, and the two being about equal in the quantity of material ejected (see also pages 166, 167).

THE GREATEST KNOWN ERUPTION

The eruption of Tomboro, on the island of Sumbawa, east of Java, in 1815, if the published reports are to be credited, appears to have exceeded all other known eruptions. It caused darkness lasting for three consecutive days at a distance of over 300 miles. Ash fell to a depth of 2 feet more than 850 miles away. Dust fell over an area of 1,000,000 square miles. The explosions were heard at a distance of 1,000 miles. The material ejected has been variously estimated at 28.6, and even at 50 cubic miles.

The eruption of Skaptar-Jökull, in Iceland, in 1783, appears to share with Tomboro the preëminence as the greatest eruption known. Comparison with the other eruptions here described is made difficult by the fact that the larger part of the material ejected was lava and not ash. The immense flows of lava from Skaptar-Jökull exceed in volume anything known during historic times. In addition to this, there were showers of ashes throughout the island, the atmosphere over Iceland was loaded with fine dust for months, crops were destroyed in Scotland, 600 miles away, and plants were blighted and sulphurous fumes were noted even in Holland, 1,100 or 1,200 miles away.

The eruption of Papandayang, in western Java, in 1772, was accompanied by the extrusion of much larger quantities of material than were thrown out by Krakatoa in 1883. Towns were buried under ejected materials at long distances from the mountain. The volcano was reduced in height from 9,000 feet to 5,000 feet.

The more famous eruptions of history, such as those of the Mediterranean, which are not mentioned above, occupy a prominent place in human, rather than in geologic, history. These volcanoes are famous because they are situated in thickly settled districts, and have consequently been familiar objects to millions of people, while their eruptions have caused great loss of life and property, not primarily because of their violence, but because of the proximity of the people and cities.

DESCRIPTION OF THE EJECTED MATERIAL

The character of the material ejected from Mount Katmai is as yet known

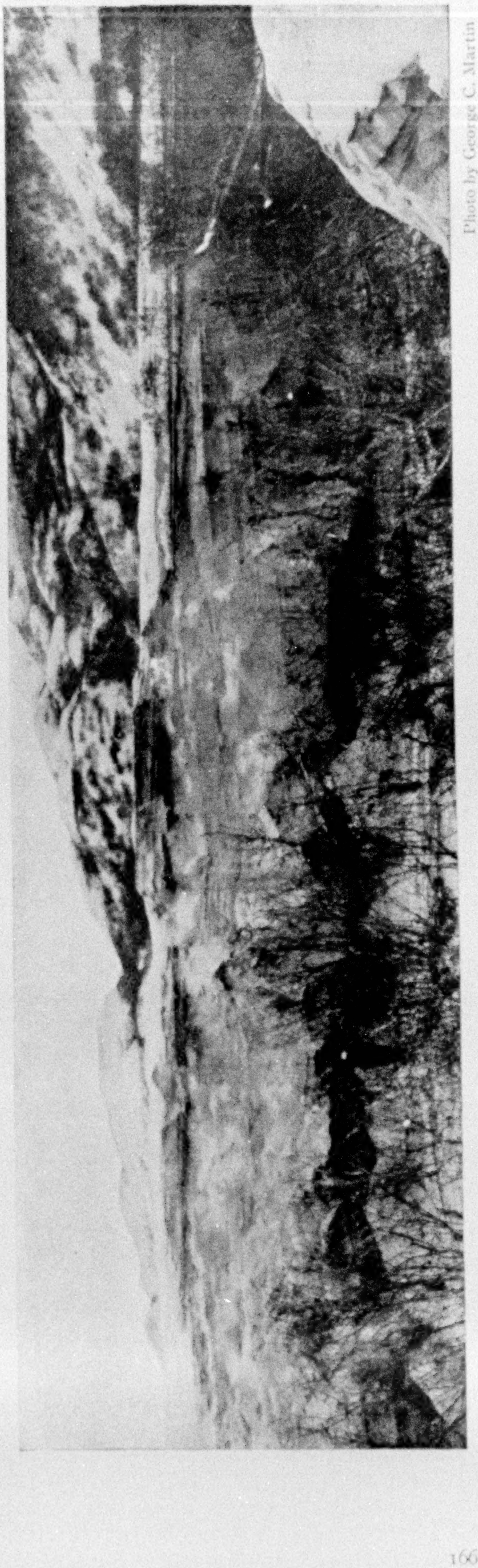


Photo by George C. Martin

ENORMOUS DRIFTS OF VOLCANIC ASHES AT AMALIK BAY, DEEPLY TRENCHED BY SUBSEQUENT EROSION: AUGUST 10, 1912

Note thickness of beds compared with height of men. This place is $15\frac{1}{2}$ miles from Katmai Volcano

only from the deposits which fell at distances greater than 15 miles from the mountain. If streams of lava flowed out, they did not come within sight of the coast. The deposits which were studied in detail vary in thickness from 55 inches at the head of Amalik Bay, $15\frac{1}{2}$ miles from the mountain, to $3\frac{1}{2}$ inches at the east end of Afognak Island, 113 miles from the volcano.

Throughout this entire district, at least three layers corresponding to the three major outbreaks can be observed. The bottom layer is of relatively coarse gray material; the middle layer is finer and is brown, and the upper layer is the finest and is light gray or almost white. Each layer decreases in thickness with the distance from the volcano, the decrease being most marked in the bottom and middle layers (see pages 132 and 176).

The bottom layer consists of fragments of pumice mixed with a small proportion of fragments of crystals of feldspars and pyroxenes and other dark minerals. The pumice is consolidated lava-froth, mostly white, and varies in size from pieces 1 or 2 ounces in weight and 2 or 3 inches in longest dimension, which fell 15 miles from the volcano, to material of the grain of fine sand, which fell 70 to 100 miles away.

The middle or brown material near the base of the mountain consists of several layers, which differ from the lower bed in containing a smaller proportion of crystalline material and in containing a considerable amount of yellowish and brownish pumice. At distances of 70 to 80 miles from the mountain this material consists of two brown layers, the lower one of sandy grain and the upper of very fine dust. At distances of 90 to 100 miles from the mountain only a single layer could be recognized, and that was composed of impalpable brown dust.

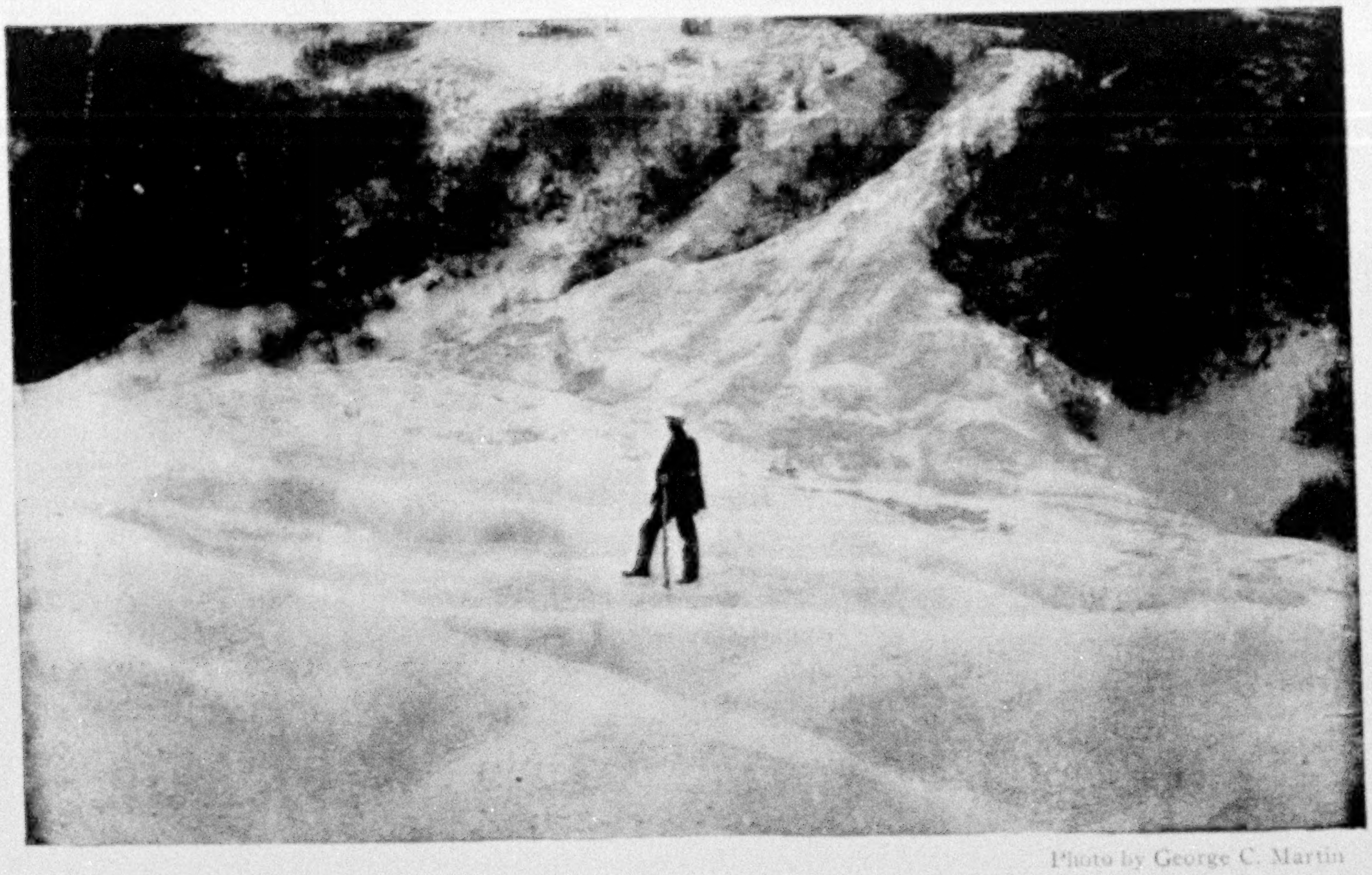


Photo by George C. Martin

SECONDARY ACCUMULATION OF PUMICE AT BASE OF MOUNTAIN WEST OF AMALIK BAY, AUGUST 10, 1912

The uppermost material consists of fine light gray or white material, varying less in grain with the distance from the mountain than the other layers. It consists of several alternating layers of fine sand and very fine dust near the mountain, and of a single layer of extremely fine white dust at a distance.

The finer material and the dust of all the layers are apparently composed chiefly of pulverized pumice of the same character as the larger pieces. This material in petrographic character is apparently rhyolitic.

The various layers aggregate about 4.9 cubic miles in bulk, extending over an area of many thousand square miles and ranging in thickness from 4½ feet 15 miles from the crater to almost one foot 100 miles away and to the fraction of an inch 150 miles away.

THE CHANGE IN THE LANDSCAPE

The effect of this covering on the landscape is well illustrated in the photographs (pages 166 and 168) taken on Takli Island, which lies in the mouth of Amalik Bay, about 21 miles southeast of the volcano, and was nearly in the direct track of the heaviest ash fall. This island is the place where those who risk the hazardous bidarka voyage across Shelikof Strait watch and wait for favorable weather. A small cove on the inner side of the island afforded shelter for our schooner during a northeast gale, which lasted several days, while the hills formed good lookout points from which the clouds pouring out from the volcano could be watched and studied at such fortunate moments as storm and fog permitted.

The island was covered with 3 feet of volcanic detritus, in which there were numerous fragments of pumice an inch long. The scene was a dreary one—a gray expanse of ashes broken only by a few ledges of ancient lava, patches of half-killed willow and stunted birch, and two small groves of young spruce. These spruce trees are of interest as being the westernmost evergreens on the Pacific coast of America. They are far from others of their kind, and I suspect that the Russians may have planted them there as they did at Unalaska.

The surface of the ash was strewn with recently killed willow and alder

Photo by George C. Martin

BUSHES AND TERTIARY BASALT PROTRUDING THROUGH ASH ON TAKLI ISLAND, AUGUST 10, 1912: NOTE LEAVES ON SURFACE OF ASH

"The scene was a dreary one—a gray expanse of ashes broken only by a few ledges of ancient lava, patches of half-killed willow and stunted birch, and two small groves of young spruce" (see page 167)

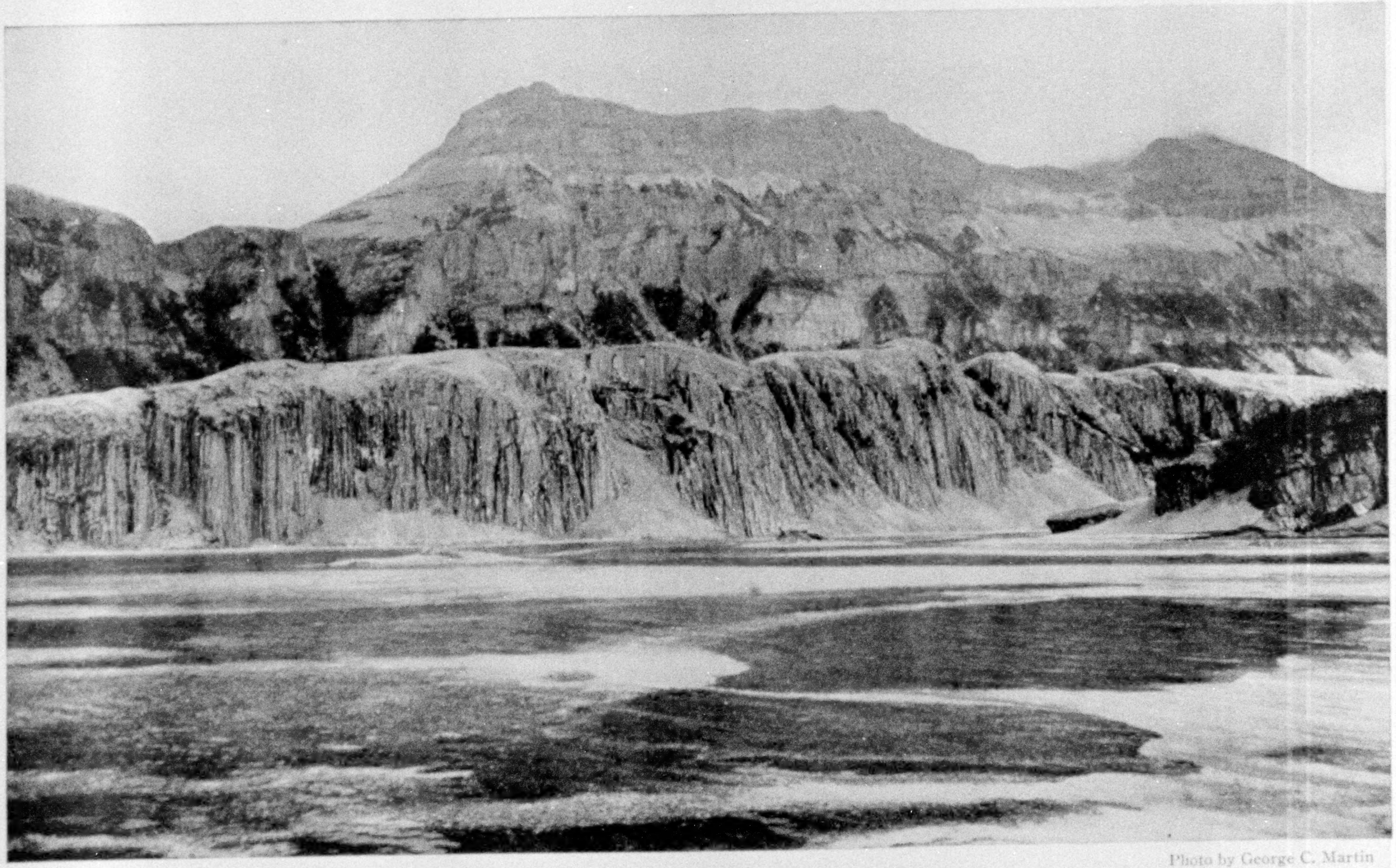


Photo by George C. Martin

CLIFFS OF COLUMNAR BASALT COVERED BY RECENT ASH NEAR HEAD OF WESTERN ARM OF AMALIK BAY, LOOKING EAST, AUGUST 10, 1912: NOTE THE PUMICE FLOATING IN THE WATER (SEE PAGES 178 AND 179)

XUM

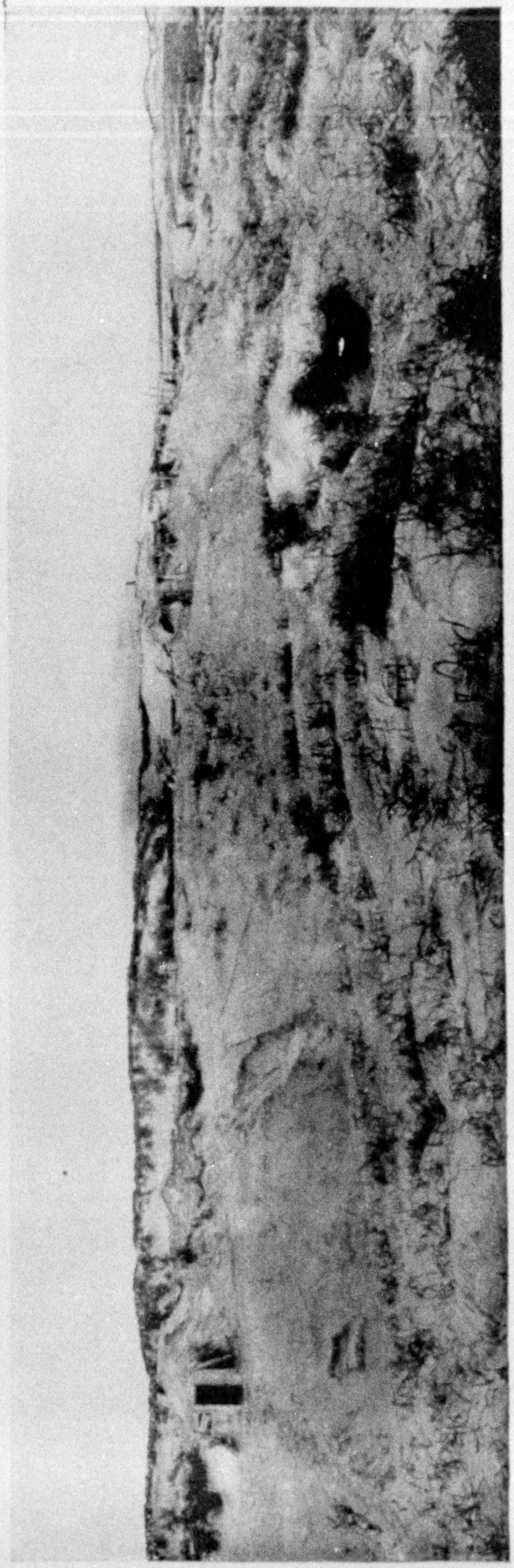


Photo by George C. Martin

DOUGLAS VILLAGE, SHOWING BARABARAS COATED WITH ASH, GRASS COMING THROUGH THE ASH, AND RUNS OF WET ASH ON THE STEEP SLOPES

The ash was thoroughly saturated from rains at the time the picture was taken, July 14, 1912

leaves, too fresh to have been killed at the eruption of June 6. They may have fallen, because the bushes were slowly dying through suffocation, or may have been withered by a more recent volcanic blast. Fumes were noticeable while we were there, in spite of the fact that the wind was prevailingly from the east.

I believe that a steady northwest wind at a time of only moderate activity would have carried sufficient fumes to make even vegetable life precarious. The only indications we saw of animal life in this locality were soaring eagles and tracks of foxes.

Amalik Bay heads back among the high mountains at a distance of about 15 miles from the volcano. We here realized that we were indeed in a volcanic land, for through the clouds of volcanic vapors which were pouring over the mountain crests and under the thick covering of the volcanic detritus of last June could be seen layer upon layer of columnar lava, aggregating at least 3,000 feet in thickness, which poured out from some mighty vents, probably in Miocene time, perhaps a million years ago. These ancient volcanic rocks, mantled by those of June, except on the cliffs too steep for the latter to lodge, are shown in all the views taken from this bay.

It was near the head of Amalik Bay that the thickest ash accumulation was found. Fifty-five inches on the level was measured at one point, this thickness representing the original fall and not a secondary accumulation. The material

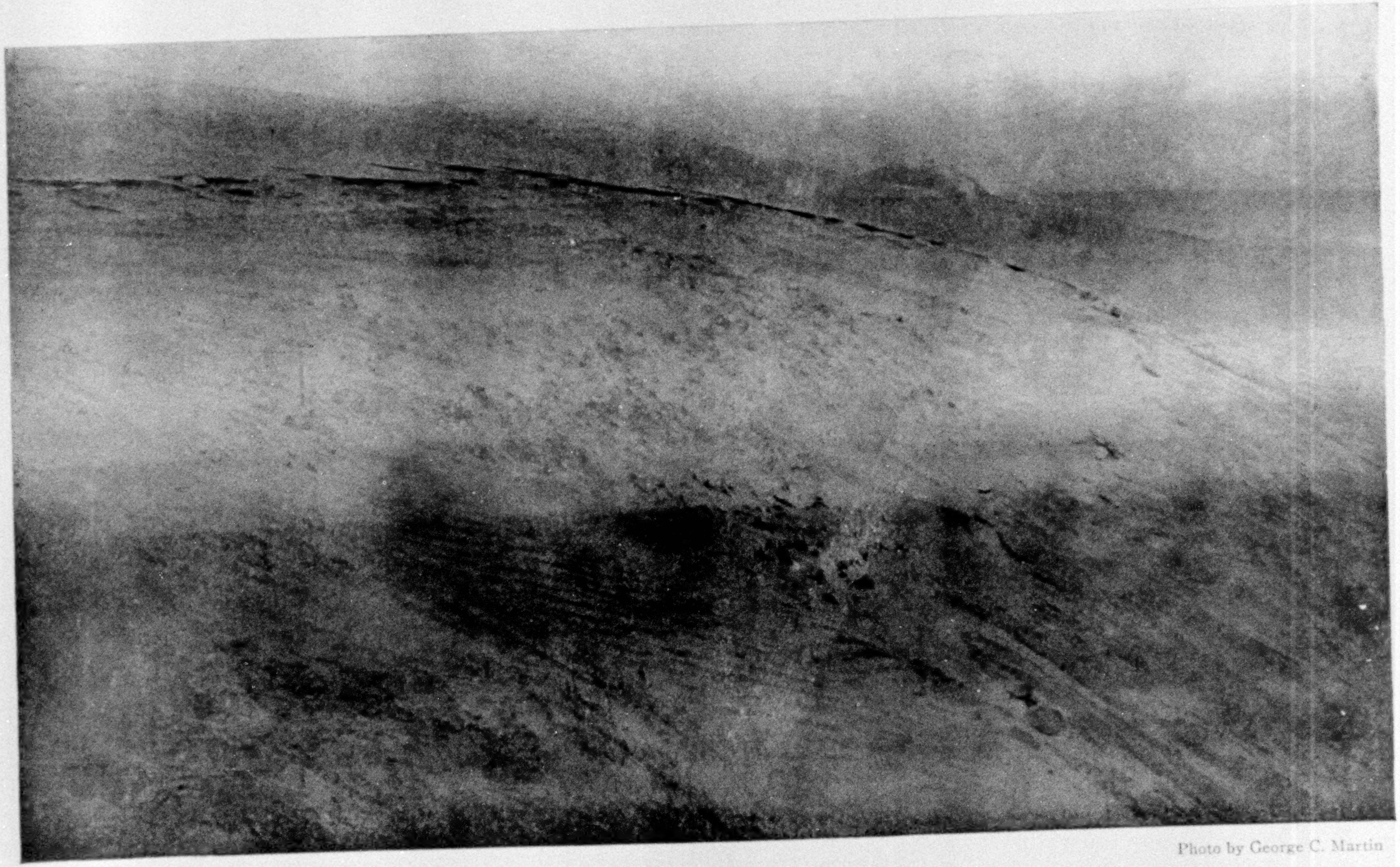


Photo by George C. Martin

WIND-BLOWN ASH NEAR KODIAK

"Hilltops and ridges are being swept bare, and thick drifts similar in form and surface to sand dunes are accumulating. At times of high wind the air is thick with drifting dust" (see page 174)

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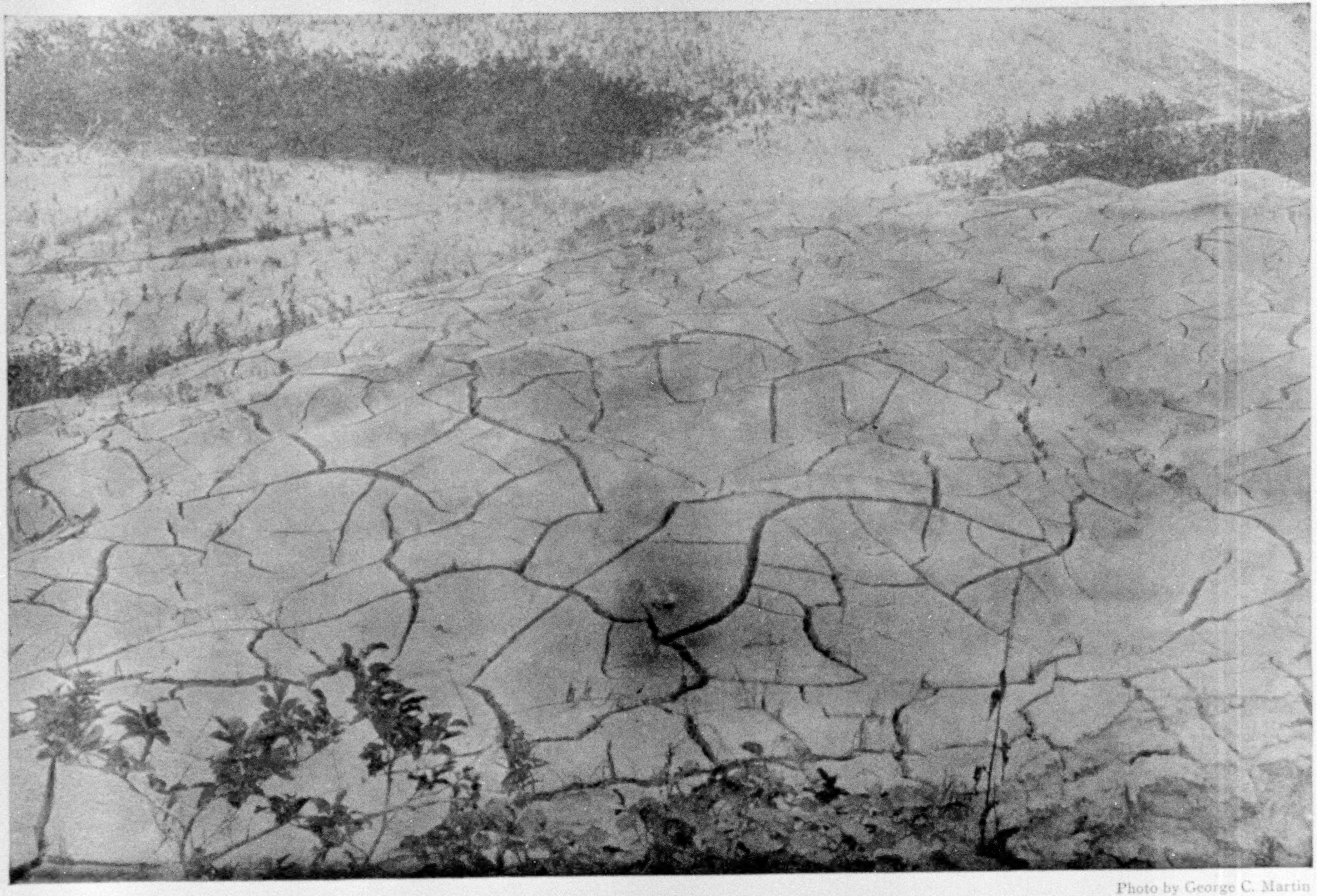


Photo by George C. Martin

CRACKS 2 INCHES WIDE AND 6 OR 8 INCHES DEEP IN ASH NEAR KODIAK, SEPTEMBER 3, 1912

The ash is 10 inches thick at this point. The billowy surface is due to the shape of the ground

Photo by Lieut. J. F. Hahn, U. S. R. C. S.

ASH SLIDE FROM THE HILLS BACK OF KODIAK

"As soon as the material fell to such a thickness that it was not held down by the grass it began sliding down the steeper slopes. This action was accentuated by the rains, and large volumes descended the steep hillsides back of Kodiak, carrying houses off their foundations and crushing in the walls" (see page 175).

DRY CHANNEL OR GULCH ERODED IN ACCUMULATION OF VOLCANIC ASHES AT BASE OF MOUNTAIN WEST OF AMALIK, AUGUST 10, 1912

included one piece the size of a brick, which had traveled through the air for 15 miles.

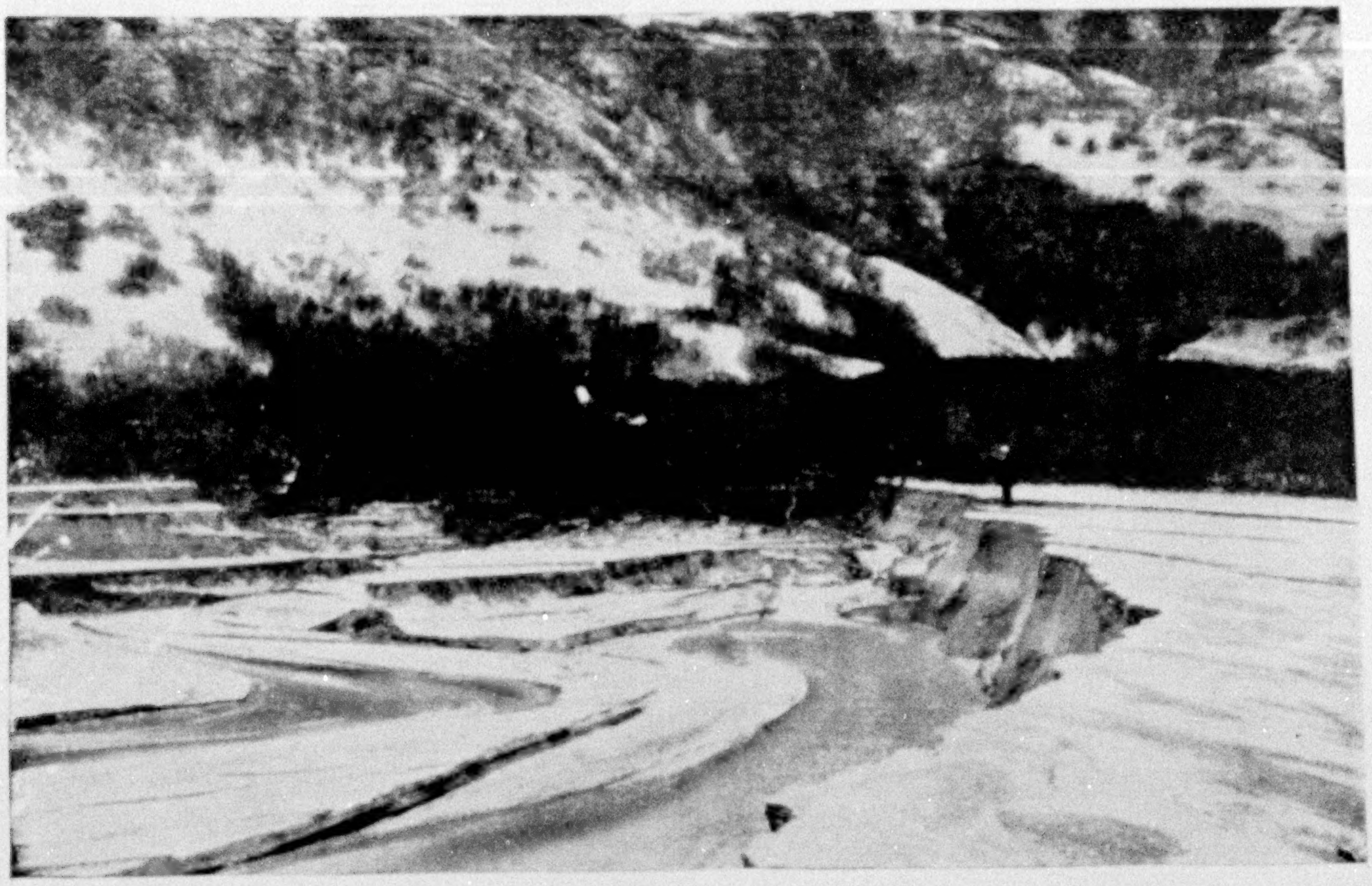
THREE DOGS ESCAPE DEATH

Katmai lies desolate on the edge of the great gray waste. It was fortunate that the people went away before the eruption, for a breath of hell swept down the valley, bringing death even to the trees. The only living things we saw were a few spears of grass, which had pushed up through the places where the wind had swept part of the ash away, and three dogs, who had escaped either by seeking refuge in the inner and deeper recesses of the barabaras or who possibly had been away on a hunt. The scene was the more deathly because it lay on the edge and in full view of the brilliantly green and undevastated country to the west (see page 146).

The appearance of this newly altered landscape is also shown in the views taken in the vicinity of Kodiak. The dust fell as a dry and impalpable powder, which was incapable of supporting weight. Heavy rains fell soon afterward, the greater part of the water being absorbed by the dust, which acquired the consistency of soft mush. It was in this condition at Douglas Village when we landed there. At every step one would sink to the ground, the feet sticking in the soft mud as in molten tar. When this water-soaked material dried, it cracked as mud does in drying. The cracks are in places 2 inches wide and extend through the two uppermost and finer layers (see page 172).

Hilltops and ridges are being swept bare, and thick drifts similar in form and surface to sand dunes are accumulating. At times of high wind the air is thick with the drifting dust. In the forested areas a large part of this dust is derived from the trees, the forests looking as if brush fires were running through them.

As soon as the material fell to such a thickness that it was not held down by the grass it began sliding down the steeper slopes. This action was accentuated by the rains, and large volumes descended the steep hillsides back of Kodiak carrying houses off their foundations and crushing in the walls. Such deposits are shown in many of the Kodiak views (see pages 134, 140, 173).



CREEK CUTTING A CHANNEL IN A DEEP ACCUMULATION OF VOLCANIC ASHES AT BASE OF MOUNTAIN WEST OF AMALIK BAY, AUGUST 10, 1912

"The streams are heavily overloaded with the volcanic detritus, and consequently are rapidly building up and extending their flood-plains, and are constructing large alluvial fans at their mouths and at points of flattening grade. Avalanches and deposition at the mouths of tributaries are changing the grades and even the courses of some of the streams. Lakes are being rapidly filled and great changes are being made in shore-lines."

DEPOSITS FORMED MORE THAN 25 FEET THICK

In the area of thicker ash-fall and on the steeper mountain slopes tremendous avalanches took place. The immense accumulations formed in this way are shown in the views from Katmai and from Amalik Bay. Much of this material had, on August 12, come to rest temporarily at least, but the enormous deposits gave evidence as to what the character of the avalanching must have been and inspired caution in climbing steep slopes.

The deposits along the stream below the waterfall, shown in view above, had been deeply trenched by the stream after it spread them. A thickness of over 25 feet was exposed and still the base of the deposits was not reached. This exposure is, moreover, not at the very foot of the hill, where the greatest thickness must have been deposited.

The streams are heavily overloaded with the volcanic detritus, and consequently are rapidly building up and extending their flood-plains, and are constructing large alluvial fans at their mouths and at points of flattening grade. Avalanches and deposition at the mouths of tributaries are changing the grades and even the courses of some of the streams. Lakes are being rapidly filled and great changes are being made in shore-lines.

MASSES OF PUMICE COVER THE SEA

The pumice is being washed into the sea by the combined action of streams, waves, and tides. There it forms great floating fields, which migrate with the winds and tides and greatly impede the navigation of small craft such as ours. An immense field of pumice which visited our anchorage at Takli Island is shown on page 178. The view shows the distance to which a dory could be forced into it. This visitor came and went under the influence of tidal currents and winds, and constituted a menace which led us to seek a more sheltered nook for our

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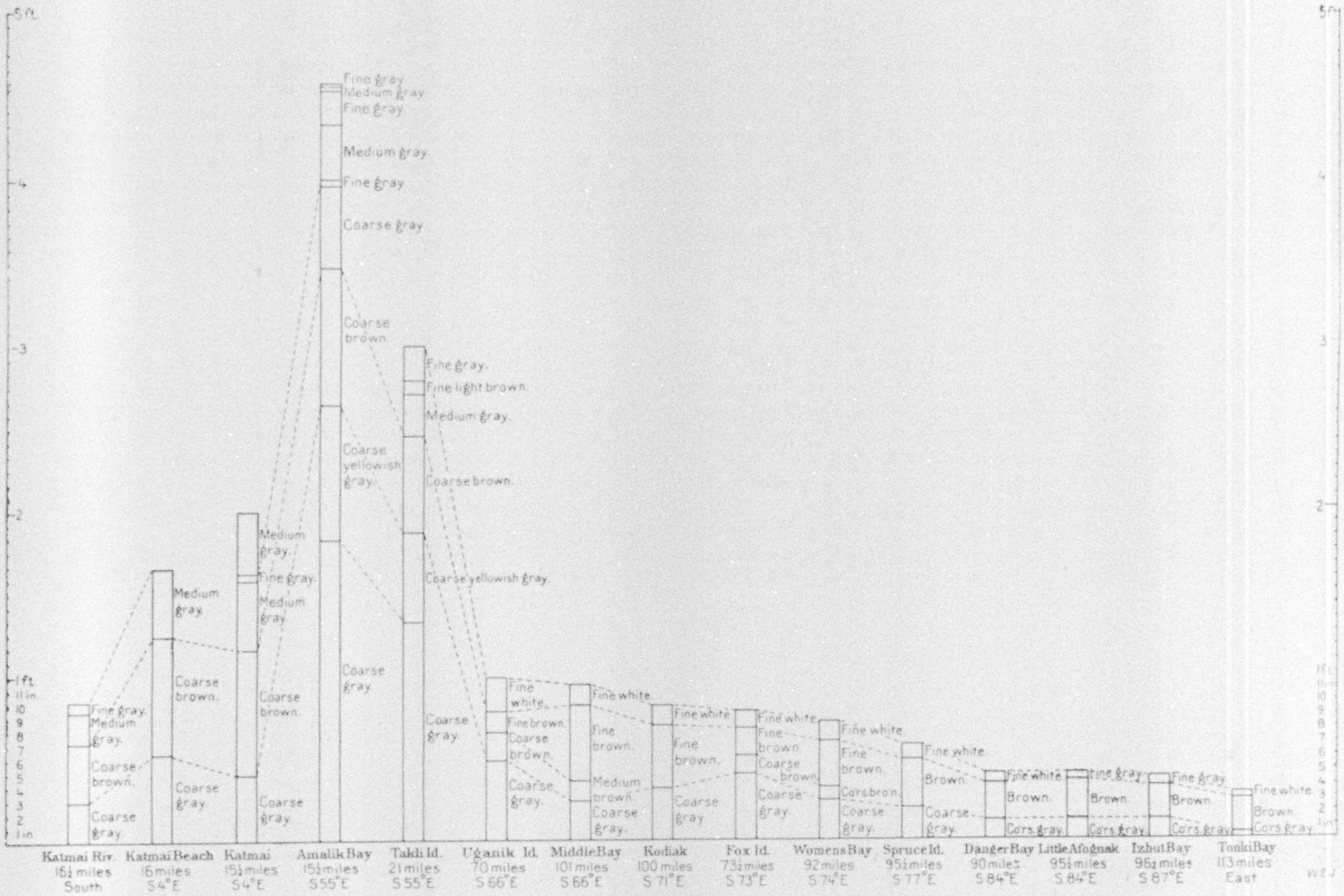

DIAGRAM SHOWING THICKNESSES OF ASH AND CORRELATION OF THE INDIVIDUAL LAYERS: THE DISTANCES AND DIRECTIONS ARE FROM THE VOLCANO (SEE PAGES 132 AND 166)

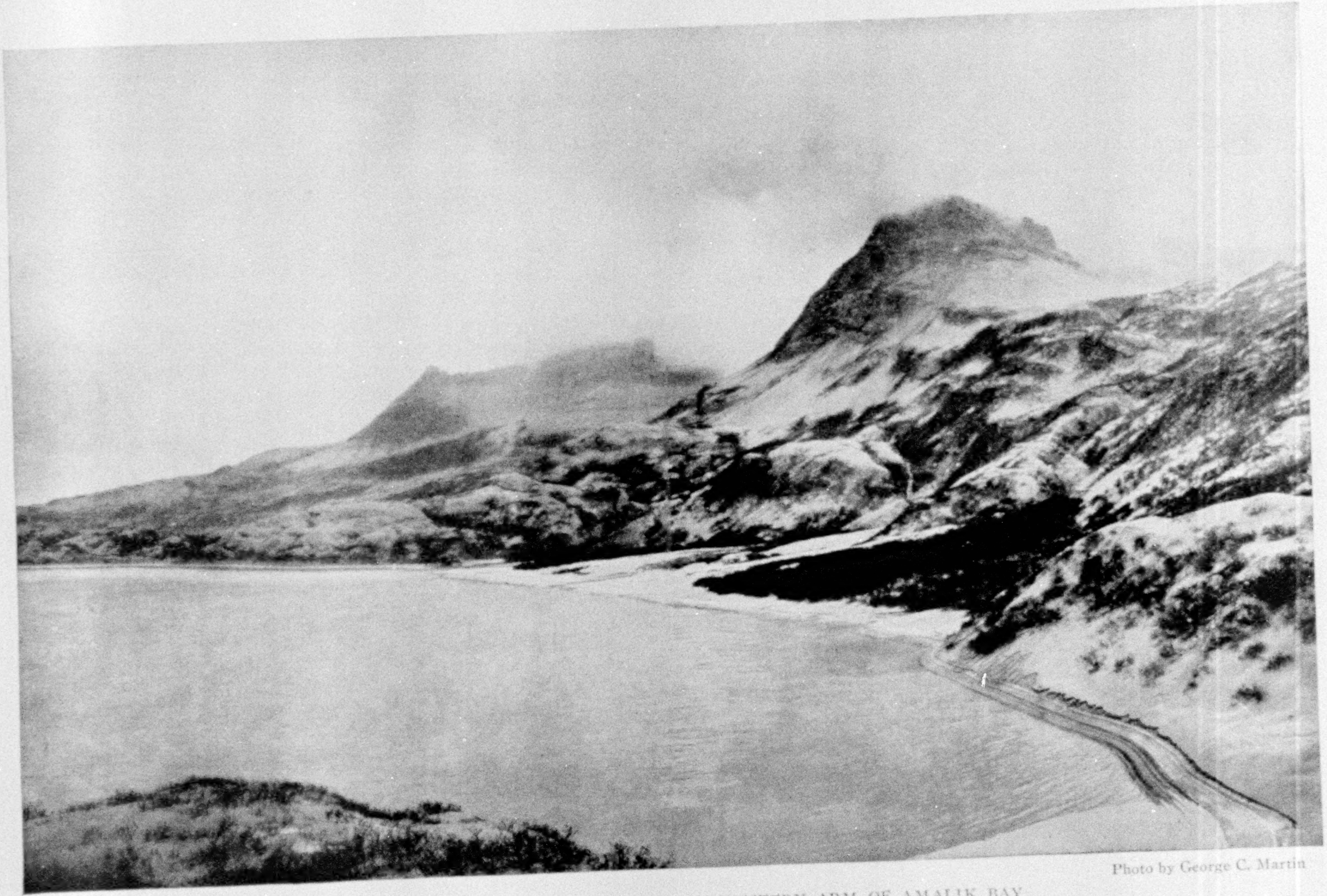

Photo by George C. Martin

LOOKING SOUTH FROM NEAR HEAD OF WESTERN ARM OF AMALIK BAY

Note the volcanic cloud pouring over the mountains and ash slides on hillside. Ash is 4 feet 7 inches thick on the level at this point. August 20, 1912

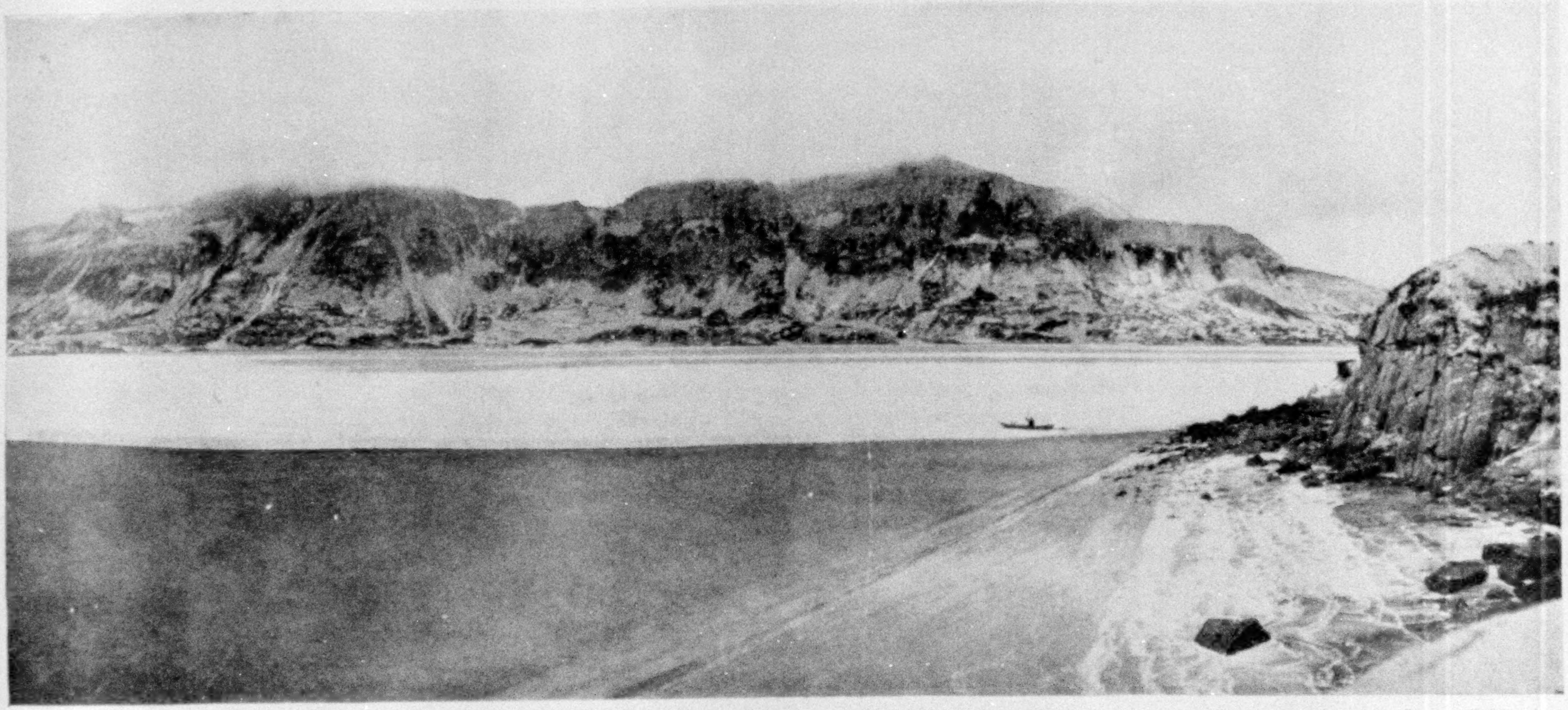

Photo by George C. Martin

A FIELD OF FLOATING PUMICE FROM KATMAI VOLCANO: AMALIK BAY FROM NORTH END OF TAKLI ISLAND

The white bands on the water are the floating pumice, while the dark area in the foreground is clear water. This is the immense field of pumice referred to on page 175. The boat has been forced as far into the field of pumice as its occupant can drive it. Note also the white streaks on the beach, which are also pumice, and the heavy ash slides on the mountain side.

Photo by John E. Thwaites

THE WAKE OF THE "DORA" THROUGH THE FLOATING PUMICE

Fishermen reported a field of pumice in Shelikof Strait dense enough to support a man. The pumice consists of rhyolitic glass, with a small amount of crystals of feldspars and pyroxenes. It is a lava which solidified at a time when it was giving off gases, and is consequently of a porous and spongy texture, which makes it so light that it will float.

boat. Even this was invaded by the floating rock, which jammed tight around and carried our boat with it when it moved, in spite of two anchors and two pieces of pig iron down, and forced us to make fast to a projecting cliff. The floating pumice was twelve inches thick alongside the boat and possibly was much thicker in the center of a large field. Fishermen reported a pumice field dense enough to support a man in Shelikof Strait.

The pumice, once in the sea, will drift around until it is thrown high upon some beach, is ground to powder, or finally becomes waterlogged and sinks.

EFFECT ON LIFE

The effect of the eruption on whatever vegetation clothed the flanks of the volcano was certainly annihilation. The position of the death-line around the mountain is not known, but it came practically down to the sea, 15 miles from the crater at Katmai. The conditions under which the bushes in Katmai Valley were killed is uncertain, but a hot blast like that of Pelée is suggested. The brush is living in Amalik Bay, no farther from the volcano, and where the fall of ash was twice as great as at Katmai.

The effect on the vegetation of Kodiak and Afognak islands was apparently only that of burial. Where the ash was washed off, even after many weeks, the grass soon came up, and apparently showed the effects of no other injury than that which would be caused by a similar burial under any other material. The stronger-stemmed plants, especially the fireweed, lupines, and some of the grasses, forced their way up through the cracks in the ash, and even through its solid mass where the thickness was not too great (see page 180).

The finer dust stuck to the trees, especially to the spruces, causing a wintry-looking scene which lasted all summer. This fine dust does not wash or shake off readily, and probably will cling to the more sheltered spruces for many years. The dust from the eruption of Redoubt in January, 1902, was still lodged on the spruces along Lake Clark in the summer of 1909. It apparently had a serious effect upon the trees, only the tops and the outer tips of the boughs showing a healthy growth. This same after effect

Photo by George C. Martin

LUPINES GROWING THROUGH CRACKS IN THE ASH NEAR KODIAK, SEPTEMBER 4, 1912

"The stronger-stemmed plants, especially the fireweed, lupines, and some of the grasses, forced their way up through the cracks in the ash, and even through its solid mass where the thickness was not too great" (see page 178).

is to be expected on Kodiak and Afognak islands and in lesser degree on the southern end of Kenai Peninsula.

The leaves of the currants, salmon berries, and many other of the shrubs and herbs on Kenai Peninsula and Prince William Sound were blighted by the dust or by the acid rain which fell there. This effect, curiously enough, did not occur in the district of thicker ash.

Marine life was affected to a larger degree than would perhaps be expected. The writer observed that the barnacles and mussels as far down as low tide in Katmai Bay were mostly dead. Kelp is apparently dead as far as the eastern end of Afognak Island. This is indeed a catastrophe, since the kelp is the one great aid to navigation on the Alaskan coast. Cod and halibut are reported to have died in great numbers in the shallower waters of lower Cook Inlet.

ANIMALS STRICKEN WITH BLINDNESS

The bears on Kodiak and Afognak islands were made bold by hunger, and attacked cattle in close proximity to the villages. It is reported that some of the bears were blind.

In the vicinity of Iliamna Lake, where not over 4 inches and for the most part less than 1 inch of ash fell, most of the small birds died, many rabbits were made blind, and the reindeer were seriously affected by the dust. Dead gulls, geese, ducks, ptarmigan, snipe, hawks, and many small birds were found at the mouth of Kakhonak River. A dead eagle was found hanging in a tree in such a position that he was probably killed by flying into the tree when blind. Blind rabbits, and birds which were either blind or had their eyes affected, were noted at several places in the Iliamna district. Small fish in some of the creeks were killed, and the fish in the lakes were driven offshore into deep water.

Small birds, squirrels, marmots, and mice were killed at Cold Bay. Mosquitoes were entirely exterminated throughout the greater part of the district in which the ash fell.

Man escaped the injuries received by the other animals by seeking shelter. Many of the people reported severe headaches, pains in the throat and lungs, and sore eyes while the dust and fumes were in the air. Two or three people in Kodiak died during the eruption, but their deaths are considered as being merely hastened by exposure and by breathing the dust and as not due primarily to the eruption.

Man was indirectly affected by the eruption through the injury to other animal life and to vegetation. The scarcity of salmon during the summer of 1912, the injury to crops and grass, and the destruction of game and fur animals must all be counted as indirect, but none the less serious, injuries to man. The effect on the salmon, through the probably complete filling of all the smaller lakes by the ash, which will for years work down the streams and hillsides into them, and through the possibly permanent destruction of the spawning grounds, is probably the most serious of these injuries.

Vegetation will be affected only temporarily, the soil will probably be improved, and the people can feel assured that not in many years, and possibly not in centuries, can the volcano accumulate enough force to cause another eruption of this character.

DO VOLCANIC EXPLOSIONS AFFECT OUR CLIMATE?

By C. G. Abbot

Director Astrophysical Observatory, Smithsonian Institution*

With Photographs by George C. Martin

IN THE month of June, 1912, I was engaged in making measurements at Bassour, Algeria, on the quantity of heat coming to the earth from the sun. At the same time my colleague, Mr. F. E. Fowle, was engaged in making similar measurements at Mount Wilson, in California. Recent work of the Astrophysical Observatory had strongly indicated that the sun is a variable star. The fluctuations in the amount of the solar radiation seemed to be of variable magnitudes, seldom exceeding 5 per cent, and occurring in irregular periods of from 5 to 10 days.

The work on which this conclusion was based had been done at Mount Wilson, in California, and it was not impossible that local atmospheric conditions may have had such an influence there that the observed changes might possibly be of atmospheric origin. To exclude this possibility it was necessary to show that the same results would be reached by simultaneous observations at another station so remote from Mount Wilson that the local circumstances would be entirely different.

Hence it was that an expedition occupied the station in Algeria in 1911, and again in 1912. As we shall not have occasion to refer again to the main purpose of the expedition, it will suffice to say here that, so far as yet reduced, high values of solar radiation obtained in Algeria coincide in time with high values obtained at Mount Wilson, and *vice versa;* so that the results seem to strongly confirm the supposed solar variation.

DUST FROM ALASKA OBSERVED IN ALGERIA

While observing on June 19, 1912, I noted streaks resembling smoke lying along the horizon, as if there were a forest fire in the neighborhood of the station. These appearances continued, and were soon joined by others more noticeable. After a day or two we began to see peculiar mottled figures like those of the mackerel sky, although absolutely no clouds were present. The phenomenon became so marked that we ceased entirely our observations of the

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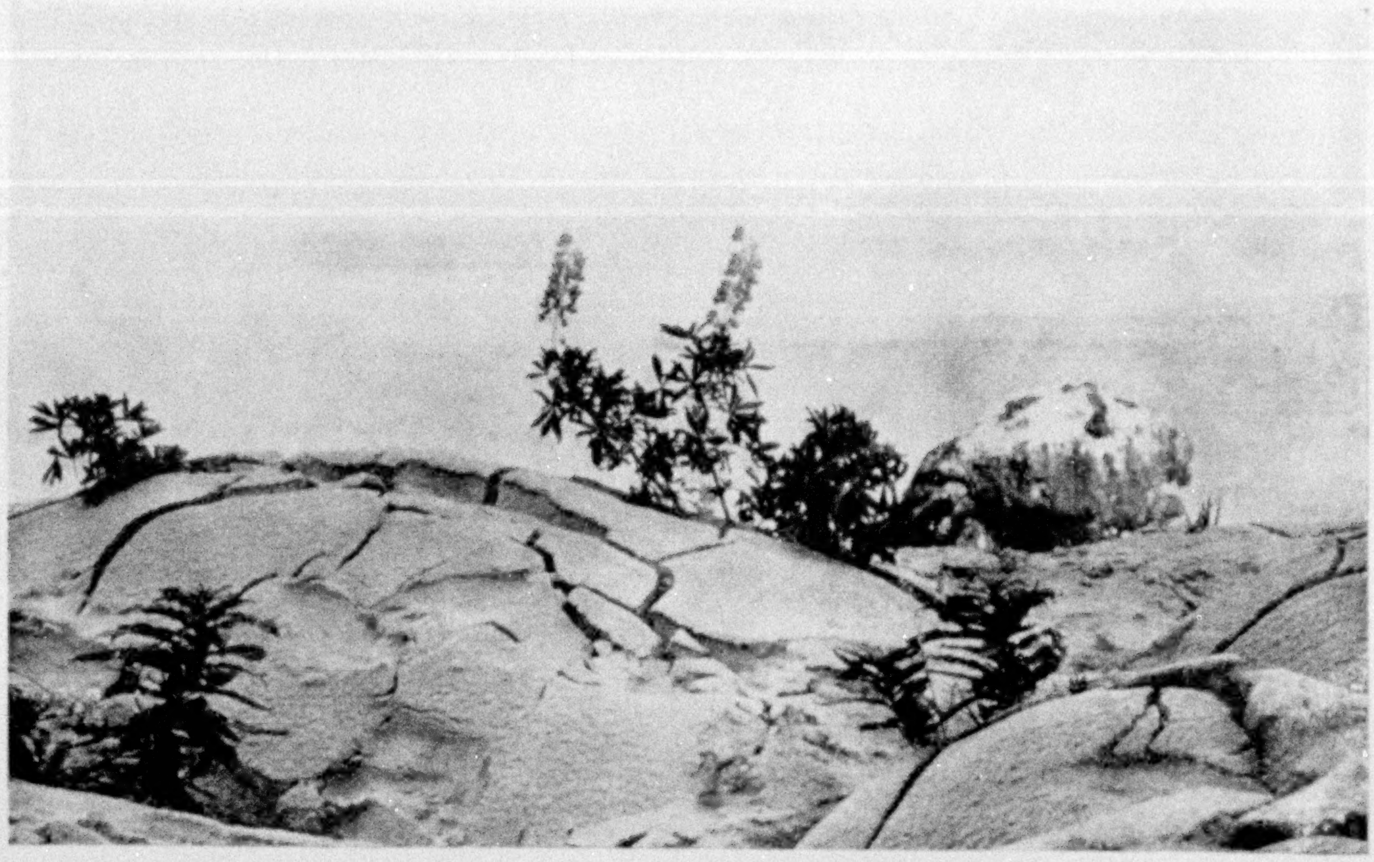

Photo by George C. Martin

LUPINES GROWING THROUGH THE ASH NEAR KODIAK

solar radiation, as the sky seemed to be quite too poor for such work.

About the 25th of June a cloudy period began, with rain, and after this, of course, we expected that all these curious sky phenomena would have passed away; but not so, for when the clouds had quite passed by, about the 29th of June, we found that the whole sky was filled with haze, and this state of affairs continued even more pronounced until the expedition left Algeria, about September 10.

For a long time I supposed the haziness was local, but in August a letter from Mr. Fowle told me that at Mount Wilson also the same conditions prevailed, and the presumption was that they were world-wide. I then recalled reading in an American paper of the volcanic eruption at Mount Katmai, and turning to the paper, which fortunately had not been destroyed, I saw that the magnitude of the eruption must have been very great, and was perhaps the cause of the phenomena which we had observed.

On my return to America I found the matter even more certain, for Professor Kimball, of the Weather Bureau, reported a great increase of haziness at Mount Weather, Virginia, beginning on June 10. European journals also began to be filled with notices of an extraordinary haziness which had prevailed throughout the summer in Europe.

THE DUST TRAVELED 25 TO 40 MILES AN HOUR

Assuming these effects to have been due to the volcano in Alaska, it is interesting to note the rate at which the disturbances were propagated. Mr. Kimball noted the effect at Mount Weather, Virginia, 3,700 miles from Katmai, on June 10 and 11. The writer noted effects in Algeria on June 19, but the observations seemed to indicate that they were becoming appreciable as early as the morning of June 17. This was at a distance of 6,000 miles.* The first observations of Mr. Fowle were noted on June 21 at Mt. Wilson, distant 2,500 miles from Mount Katmai.

The rates of propagation then were roughly as follows: Toward Washington, 40 miles per hour; toward Bassour, 25 miles per hour; toward Mount Wilson, 3 miles per hour. The great delay in reaching Mount Wilson was doubtless because the prevailing winds in the higher atmosphere have a course from westerly

* By shortest course directly over the North Pole. It is probable that the actual course was much longer.

Photo by George C. Martin

BLUEBELLS AND MOSS AMONG THE ASHES: MIDDLE BAY, SEPTEMBER 12, 1912

toward easterly, so that Mount Wilson lay decidedly too far to the south for the most favorable communication.

HOW THE SUN'S HEAT IS MEASURED

Before taking up the question of the reasonableness of the hypothesis that the dust from Mount Katmai was distributed all over the higher atmosphere and remained there for months in suspension, we may consider for a moment the exact effects which were observed with our apparatus and the nature of the apparatus with which these effects were observed.

In the first place we have the pyrheliometer, an instrument for measuring the heating effect of the sun at the earth's surface. In the second place we have the spectro-bolometer, that wonderful device of Langley for observing the excessively minute heating effects of the rays of the solar spectrum. Imagine that you have before you a very intense solar spectrum, and that it is still early morning, with the sun perhaps an hour and a half high.

If you had a thin, delicate blackened thermometer, you could carry it along in the spectrum from the extreme ultra-violet to far beyond the red, and detect varying degrees of temperature rise, proportional to the heat produced by each spectral ray. It would make no difference whether these lay between the violet and the red and were visible to the eye, or were the short wave-length photographic rays beyond the visible end of the violet spectrum, or the long wave-length rays lying beyond the visible end of the red. All would produce their just and proportional heating effects upon this delicate thermometer. At each of the Fraunhofer absorption lines the thermometer would fall slightly.

The "A" band of oxygen would produce a comparatively great decrease of temperature, and beyond the red there would be still more prominently the great bands, due to the water vapor in the earth's atmosphere.

Suppose now that several hours later you repeated the experiment. You would find that, excepting in these great water-vapor bands, practically every part of the spectrum was hotter than before, and that the change had been greatest in the violet end. Knowing the altitude of the sun above the horizon at each time of observation, you could compute the thickness of the layer of air traversed by the solar beam.

Photo by George C. Martin

ASH IN FOREST NEAR HEAD OF WOMAN'S BAY, NEAR UZINKI, AUGUST 1, 1912

From this it would be possible to determine how much the intensity of the rays would have been increased had the observation been made outside of the atmosphere altogether—as if it could have been made, for instance, upon the moon. From this result one could determine how much the rays of each part of the spectrum were diminished in intensity by their passage through the atmosphere on their way to the surface of the earth.

AN INSTRUMENT THAT MEASURES ONE-MILLIONTH PART OF A DEGREE OF HEAT

No ordinary thermometer would be of any value for this purpose; but the bolometer invented by Langley about 1881 is an electrical thermometer so sensitive that a change of temperature of 1 one-millionth part of a degree is observable with it under ordinary conditions.

We were equipped with such an apparatus at Bassour, and Mr. Fowle had one similar on Mount Wilson, and with these, following the scheme of operations which I have indicated above, we measured for all rays of the solar spectrum the transparency of the atmosphere. Similar measurements have been made at Mount Wilson for many years, and were made in Algeria in the year 1911. The following table shows the decrease in the transparency of the atmosphere, first for the beam of the sun as a whole, and then for the rays of different regions of the solar spectrum:

Percentage Decrease of Direct Solar Radiation by Haze of 1912

Computed for Solar Zenith Distance 48°

Station.	Bassour.			
Radiation.	Total.	Ultra-violet.	Green.	Infra-red.
Wave-length.....	All.	3,700	5,300	10,000
July 1 to 31	18.0	21.4	22.2	16.8
August 1 to 31 ...	19.3	19.7	24.3	14.9
September 5......	16.4	14.3	18.3	14.9

Station.	Mount Wilson.			
Radiation.	Total.	Ultra-violet.	Green.	Infra-red.
Wave-length.....	All.	3,700	5,300	10,000
July 1 to 31	10.7	15.5	12.9	5.4
August 1 to 31 ...	16.8	27.5	23.1	14.0
September 5......	17.1	....	....	....

20 PER CENT OF SUN'S HEAT LOST IN 1912

From these results we see that the uncommon haziness of the sky during the

summer of 1912 produced a very marked decrease in the direct solar radiation in all parts of the spectrum,* and reached nearly 20 per cent at high sun for the total heat.

There was, however, some compensation in the increased brightness of the sky for this apparently very great loss in 1912. In order to understand this, think for a moment what happens to the sun-rays before they reach the earth's surface. *If we could go outside the earth's atmosphere—to the moon, for instance—the sky would look dark as it does at night, studded with stars, except when we looked directly toward the brilliant sun, which would shine wholly undimmed.* It is the earth's atmosphere which changes all this, for in the passage of a sunbeam through it, even on a cloudless day, two kinds of losses occur—one imperceptible to the eye, the other giving us the skylight.

Firstly, some of the invisible rays of the infra-red spectrum are totally absorbed by the water vapor, oxygen, and carbon-dioxide of the earth's atmosphere, and cease to exist as radiation long before the sunbeam reaches the earth's surface. Secondly, the molecules of the air and the fine dust suspended in it scatter and diffusely reflect the sun-rays, and make the sky bright, much as the motes of dust in a sun-lit room reveal the path of the sunbeam in it.

Thus, of the sun-rays scattered in the earth's atmosphere, some reach the observer at the earth's surface, coming no longer from the sun directly, but diffusely reflected from every part of the sky. The remainder are scattered away into space and lost altogether for the purpose of heating and lighting the earth.

HEAT REFLECTED INTO SPACE INSTEAD OF REACHING THE EARTH'S ATMOSPHERE

It is this last-mentioned portion which most interests us here, for we wish to inquire how much more heat than is usual was lost to the earth by reflection of the atmosphere to space in 1912, owing to the dust which came from Katmai volcano. One can easily see that since the light of the sky and the loss by reflection to space both depend on the presence of the molecules and the dust of the atmosphere, an increase of the dust (at least up to a certain point) must make the sky brighter and the loss to space greater also.

What, then, do we ordinarily receive from the sun?

(A) The direct solar beam.

(B) The skylight.

What else would we have received if there were no atmosphere?

(C) The rays absorbed by atmospheric vapors.

(D) The rays reflected away to space from the upper atmosphere.

The sum of these four quantities should be approximately equal to the heat of the solar beam outside the earth's atmosphere, as, for instance, on the moon. This we may call (E). As we cannot measure (D) directly, we must find it by subtracting A+B+C from E. It is of course (D), the loss to space, with which we are principally concerned.

For we must ask ourselves: *Was the earth's loss of heat by reflection of the upper air to space made greater by reason of the haze of 1912?* To answer this we must know the value of the expression (D)={E—(A+B+C)} as it was in 1912 and as it is ordinarily.

Measurements of (A), the direct sun-rays, and (C), the water vapor and other absorption, we make every day, and I devised and built with my own hands at Bassour two pieces of apparatus for measuring (B), the light of the sky. From observations taken a little before noon on September 5, 6, and 7, 1912, we found at Bassour the following results, stated in calories per sq. cm. per minute:

(A) Heating effect of the direct beam of zenith sun	1.250
(B) Heating effect of the entire sky	0.245
(C) Heating effect of the rays absorbed by water vapor from sun and sky radiation	0.175
Total (A + B + C)	1.670
(E) Heating effect of total radiation outside the earth's atmosphere (from the moon, for instance)	1.950
(D)=(E)−[(A)+(B)+(C)]	0.280

* This circumstance must have caused a decided increase in the exposures required by photographers for solio prints.

The difference between the heat outside the earth's atmosphere and the sum of the various parts of it indicated above is 0.280 calory per sq. cm. per minute, and this we may suppose represents approximately the loss of heat by reflection from the atmosphere to space in the summer of 1912.

In former years similar experiments to these have been made at Mount Wilson and Mount Whitney, and it was found in each case that the sum of the radiation: (A) of the direct solar beam, (B) from the sky, and (C) lost by the absorption in the atmosphere, lacked less than 0.05 calory of the total heating effect outside the atmosphere.

I am of the opinion that the difference between these results of 1912 at Bassour and those of earlier years at Mount Wilson and Mount Whitney (or about 0.20 calory) represents approximately the radiation reflected away to space by the volcanic dust of 1912, or, in other words, the loss of heat available to warm the earth, which we must attribute to the great haziness which prevailed in 1912. The difference is about 10 per cent of the whole intensity of the sun's radiation outside the atmosphere. *Hence I conclude that the dust of Katmai diminished the heat available to warm the earth in the north temperate zone by about ten per cent during the summer of 1912.*

In accordance with the laws of heat and radiation, this might produce a fall of 7° centigrade in the temperature of the earth as a whole, if it was effective for a long enough period of time, provided that there were no counteracting influences, such as altered cloudiness or decreased nocturnal earth radiation, brought about at the same time with, and perhaps by reason of, the increased haziness of the atmosphere.*

WORLD-WIDE HAZE CAUSED BY TERRIFIC ERUPTIONS IN JAPAN AND ICELAND

Having now given estimates of some effects of the great haziness of 1912, we shall next consider whether volcanoes can really produce such world-wide haze. To answer this we have only to go back to the records of times of the greatest volcanic actions of the last 150 years.*

In the year 1783 occurred the eruption of Asamayama, Japan, stated to be the most frightful eruption on record. Immense rocks were hurled in all directions and towns and villages buried. *One stone, said to be 264 × 120 feet, fell into a river, and looked like an island.*

In the same year occurred the (if possible) still more extraordinary eruption of Skaptar Jökull, in Iceland, beginning near the end of May and producing the most violent eruptions on June 8 and 18. Arago records that the dry "fog of 1783 commenced about the same day (June 18) at places distant from each other, such as Paris and Avignon, Turin and Padua. It extended from the north coast of Africa to Sweden and lasted more than a month.

The lower air did not seem to be its vehicle, for in some parts the fog came on with a south, in others with a north, wind. Abundant rains and the strongest winds did not dissipate it. In Languedoc its density was such that the sun was not visible in the morning up to 17° altitude above the horizon. The rest of the day the sun was red, and could be observed with the unprotected eye. At the time of new moon the nights were so bright that the light was compared to that of full moon, even at midnight."

In 1814 occurred the great eruption of the volcano of Mayon, in the Philippine Islands, and on April 7 to 12, 1815, the

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* The results here given on the combined brightness of the sun and the sky must as yet be regarded only as provisional. No experiments were made at Bassour on the brightness of the sky prior to the coming on of the haze; hence we shall be obliged to wait until the haze has entirely cleared before we can have measurements strictly representative of the conditions which would prevail there in a clear sky. Dr. Dorno, observing at Davos, in Switzerland, does not confirm my conclusion that the total brightness of sun and sky was decreased by the presence of the haze, although he found very strong effects of the haziness in reducing the intensity of direct sun rays, and noted even that the combined brightness of sun and sky in the green had fallen off by 7 per cent as compared with that of the combined brightness in the red. His measurements of the combined brightness do not extend to the whole spectrum, so that it is possible that in this fact may lie the explanation of the divergence between his results and mine.

* See Report of Krakatoa Committee of Royal Society of Great Britain.

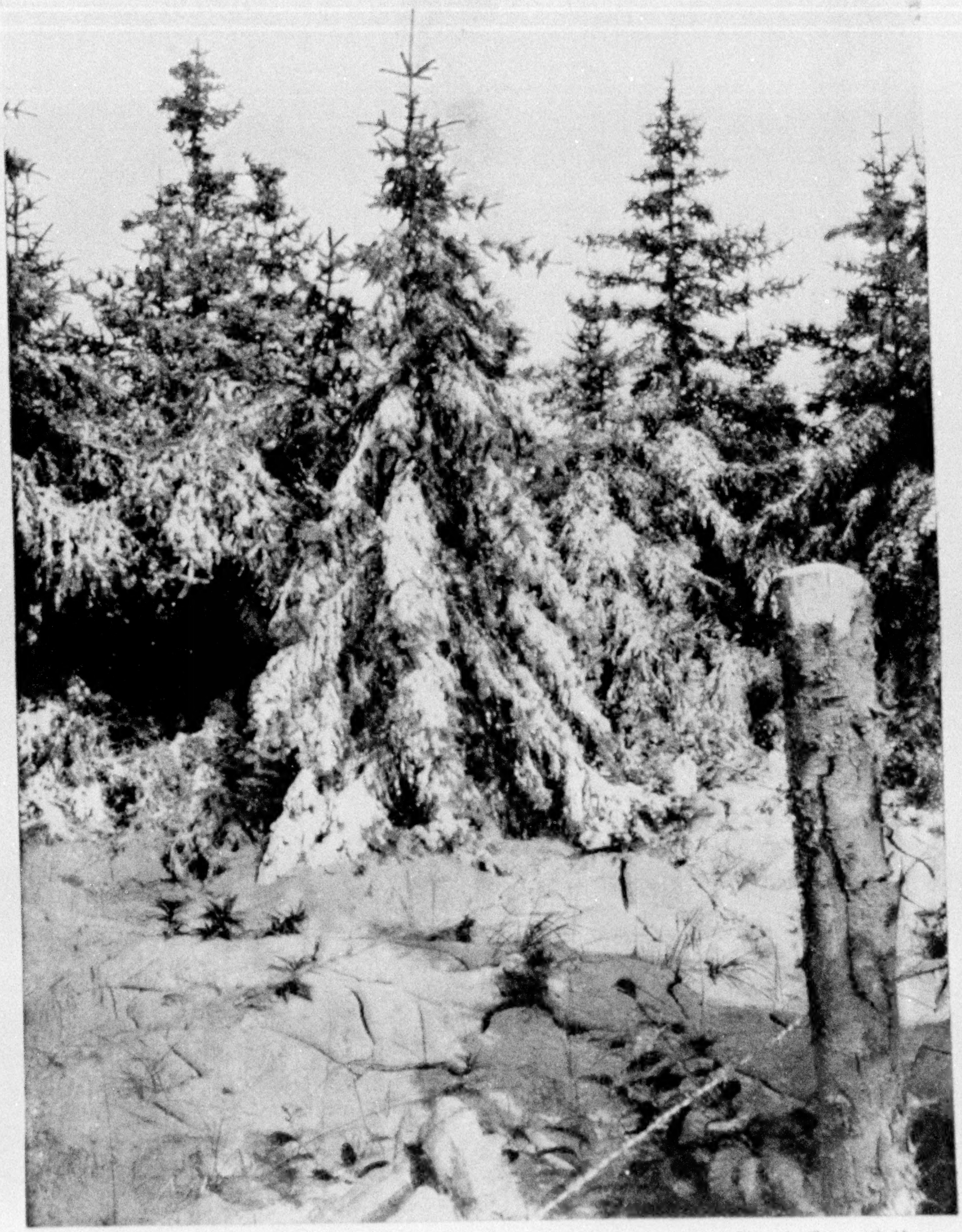

Photo by George C. Martin

ASH-LADEN TREES NEAR KODIAK, AUGUST 26, 1912

(See article by George C. Martin, page 179)

XUM

Photo by George C. Martin

POLEMONIUM IN BLOOM AT BASE OF ASH-COVERED CLIFF NEAR KODIAK, SEPTEMBER 4, 1912

extraordinary eruption of Tomboro, Sumbawa, of which it is said "this eruption was the greatest since that of Skaptar Jökull, in 1783." *For three days there was darkness for a distance of 300 miles.* After these extraordinary eruptions there were noted in Europe streaky skies, haziness, long twilights, and red sunsets; so that "the year 1815 is the most remarkable as regards sunset lights recorded up to that date."

THE DRY FOG OF 1831 AND 1883

Passing on to the year 1831, there occurred three moderate eruptions and three more of the very first magnitude. Graham's Island was thrown up, and eruptions took place in the Babujan Islands and at Pichincha.

Arago says: "The extraordinary dry fog of 1831 was observed in the four quarters of the world. It was remarked on the coast of Africa on August 3, at Odessa on August 9, in the south of France and at Paris on August 10, in the United States on August 15. The light of the sun was so much diminished that it was possible to observe its disk all day with the unprotected eye. On the coast of Africa the sun became visible only after passing an altitude of 15° or 20°. M. Rozet, in Algeria, and others in Annapolis, United States, and in the south of France saw the solar disk of an azure greenish or emerald color. The sky was never dark at night, and at midnight, even, in August, small print could be read in Siberia, at Berlin, Genoa, etc. On August 3, at Berlin, the sun must have been 19° below the horizon when small print was legible at midnight."

Passing over, among many others, for lack of space, the great eruptions of Hecla in 1845 and 1846, and those of Vesuvius and Merapi in 1872, we come to the tremendous explosion of Krakatoa of August 27, 1883, and the eruption of St. Augustine, in Alaska, October 6, 1883. The extraordinary atmospheric phenomena which closely followed these remarkable volcanic eruptions were so evidently in the relation of effects to causes that there can be no doubt as to the reasonableness of ascribing the haze of the past summer to the volcanic eruption in Alaska, provided that eruption

was comparable in magnitude to those of which we have spoken.

KATMAI DEPOSITS ONE FOOT OF ASHES 100 MILES AWAY

The eruption of Mount Katmai volcano reached its most vigorous phase on June 6 and 7, 1912. Observations were made by Captain Perry, of the revenue cutter *Manning*, at Kodiak Island, situated 100 miles from the volcano. At 5 o'clock, June 6, a noise like distant thunder was heard and ashes began to fall. Thunder and lightning were frequent, and the sky became dark, although two hours before sunset.

When the deposit of ashes ceased, at 9 a. m. of June 7, about 5 inches of ashes had fallen. At noon they commenced to fall again, and increased in density, until at 1 o'clock it was impossible to see beyond a distance of 50 feet. *At 2 o'clock pitch darkness had set in, and although all ashes of the previous day had been removed from the ship, yet the decks, masts, and yards were again heavily laden, and the men worked incessantly with shovels and streams of water to clear the decks, falling over one another in the blackness.*

At 2.30 p. m. of June 8 the fall of ashes decreased, the sky assumed a reddish color, objects became dimly visible, and the deposition ceased by the morning of June 9. At Kodiak Island, 100 miles from the volcano, the ashes reached the average depth of one foot. (See article by George C. Martin in this number.)

THE VOLCANIC EXPLOSION OF KRAKATOA WAS HEARD 3,000 MILES AWAY

In order to compare the intensity of this volcanic outbreak with the great outburst at Krakatoa in 1883, which stands at the high-water mark of volcanic activity for the past century, it will be interesting to review some of the phenomena of the Krakatoa eruption as stated in the report of the Krakatoa Committee of the Royal Society of Great Britain.

May 20, 1883, booming sounds were heard at Batavia and Buitenzorg, towns in Java, situated about 100 miles from Krakatoa, and on May 21 a sprinkling of ashes was noticed on both sides of the Strait of Sunda. From this time until August 26 the eruption of Krakatoa continued with considerable intensity, although several times parties landed on the island.

On August 26, 27, and 28, violent explosions occurred, which *blew away the whole northern and lower portion of the island of Krakatoa, leaving submarine cavities sometimes a thousand feet deep where before the island had risen to 1,400 feet above sea-level.* The water wave following the greatest explosion of August 27 was estimated to be 50 feet deep or more when it reached the coasts of Java and Sumatra. *A ship of war was carried inland for nearly 2 miles, and left 30 feet above sea-level.* Between 30,000 and 40,000 people lost their lives by the overwhelming of their villages.

The explosion was heard as far as the island of Rodriguez, nearly 3,000 miles away, and *the area over which the actual noise of the explosion was heard embraced one-thirteenth of the area of the globe.* The air waves traveled outward from the volcano as a center till they reached the antipodes in South America, were then reflected backward to their origin, and from there returned, so that they were observed by the meteorological stations to have made four complete passages away from Krakatoa and three in return before their traces were lost.

The sea waves were several feet high after crossing the Indian Ocean, and at a distance of several thousand miles, and were even thought to be observed by the tide gauges of the English Channel. The height of the column projected from the volcano on August 26 was measured as 17 miles (89,760 feet).

Beginning shortly after the eruption, the sky at distant regions of the earth became hazy, and abnormally long twilights and sunset glows continued to be observed even as much as two years after the occurrence. It was computed that the fine dust from the volcano reached an altitude at first of 120,000 feet and was still at a height of 50,000 feet more than a year after the eruption.

XUM

Photo by George C. Martin

THE REMAINS OF AN AVALANCHE OF VOLCANIC ASH WHICH WRECKED MANY OF THE HOUSES IN THE TOWN OF KODIAK

BUT KRAKATOA DID NOT EJECT AS MUCH ASHES AS KATMAI

Although the violence and destructiveness of this celebrated eruption places it in the first rank, and the quantity of matter ejected was very great, yet when we compare the depth of ashes falling at considerable distances from the Island of Krakatoa with the quantity of ashes which fell on Kodiak Island after the eruption of Mount Katmai it appears that the volcano of Krakatoa was far inferior in this respect to the recent one.

According to the investigations of Verbeek, the average depth of the ashes at the distance of 100 miles from the volcano of Krakatoa was about one quarter of an inch. We have seen that at Kodiak Island the depth of the deposit from Katmai was about one foot and the average depth at a distance of 100 miles from Katmai at least one inch (see page 132). If, then, the air was filled with haze from Krakatoa for two years after the eruption, it need not surprise us that a great amount of haze occurred following the eruption of Katmai.

But it must not be forgotten that the violence of the eruption of Krakatoa was most extraordinary. It is possible that although the amount of ashes sent out from Mount Katmai may have greatly exceeded the quantity sent out from Krakatoa, yet the height to which the ashes were projected in the atmosphere by Krakatoa may have greatly exceeded the height to which they were projected from Katmai. Thus perhaps we ought not to infer that the meteorological consequences of Katmai should last as long as those extraordinary ones which were observed after Krakatoa. Recent pyrheliometer measurements, however, show that in January, 1913, the sky was still abnormally hazy.

It is only since just before the Krakatoa eruption that we have had measurements of the intensity of solar radiation comparable to those which were available in 1912. From a paper of Prof. H. H. Kimball* I copy the accompanying illustration, which shows the fluctuation of the annual solar radiation received at the earth's surface as measured at different stations.†

VIOLENT VOLCANIC OUTBURSTS SERIOUSLY DIMINISH THE AMOUNT OF HEAT WE RECEIVE FROM THE SUN.

It is apparent that very great departures from the usual intensities occurred from 1883 to 1887, 1888 to 1893, and from 1902 to 1904 respectively. Having now convinced ourselves that such departures may reasonably be expected in consequence of great volcanic eruptions, it is interesting to find, if we can, the causes of the diminished solar radiation at about 1891 and 1903 respectively.

The activity of the Island of Vulcano lasted 20 months—from August 3, 1888, to March 22, 1890. The most violent explosions occurred on August 4, 1888; December 26, 1889, and March 15, 1890. An eruption which took place there on January 6, 1889, was observed by A. Ricco from the Observatory of Palermo to be sending a column of smoke to the height of more than 6 miles.

An eruption of Mayon, in the Philippine Islands, took place December 15, 1888. Vast columns of ashes ascended from the crater, and in a short time the darkness was so intense that, though it was midday, lights had to be used in Manila. Violent eruptions were also reported in the same year in other islands of the Philippine group.

A vessel passing the Island of Oshima, in Japan, reported violent eruptions of the volcano of Miharaizan on April 13, 1889. On January 16, 1890, a violent eruption took place at Mount Zoo, near the town of Fukuyama, in Japan.

In February, 1890, there was the volcanic eruption at the Island of Bogoslof, in Bering Sea. Three small new islands were created in the immediate vicinity and the island was raised 1,000 feet. Ashes were collected in Unalaska, about 40 miles distant.

BANDAI-SAN THROWS UP 700 MILLION TONS OF MATERIAL

On June 7, 1892, a severe eruption

* Bulletin of the Mount Weather Observatory, vol. 3. Part II.

† Professor Kimball's data comprise the four broken lines near curve A of the figure, page 196. I have marked them 1-1 (from 1883 to 1900); 2-2 (from 1896 to 1903); 3-3 (from 1901 to 1905); 4-4 (from 1906 to 1909). The results of different observers have been combined and smoothed, as will be stated below. Results of this kind from single stations are much influenced by local haziness. In future years much fuller information will be available.

began from a volcano near the capital of the Island of the Great Sangir. Some thousands of people were killed and immense quantities of ashes fell all over the island. The noise of this eruption was heard at Sandakan, 500 miles away.

An eruption of Mount Etna began on the nights of July 8 and 9, 1892, and continued with more or less intensity all the month. Occasional less severe outbreaks occurred afterwards. The eruption was notable for the enormous quantities of smoke and sand emitted.

But undoubtedly the greatest eruption of this period occurred in northern Japan. Bandai-San is a mountain about 5,800 feet high, which had shown no sign of activity for about 1,100 years. A subordinate peak, called "Little Bandai-San," arose on its northeastern side. On the morning of July 15, 1888, "Little Bandai-San" was blown completely into the air and obliterated. The debris buried and devastated an area of at least 30 square miles. An estimate based on the depth of the debris in this area indicated that the quantity of earth, rocks, and volcanic material reached 700 million tons, and that doubtless the true figure would be much greater. About 600 people perished horribly and many more were reduced to destitution.

It was, with one possible exception, the most terrible volcanic disaster which had occurred in Japan since the famous explosion of Asamayama in 1783. The force of an explosion capable of tearing a mountain to bits and distributing it over an area of 30 square miles may well have been sufficient to blow the column of ashes high enough into the air to have been carried over the earth like those ejected from the crater of Krakatoa in 1883.

THE DEVASTATION WROUGHT BY MONT PELÉE

The town of St. Pierre, on the Island of Martinique, was struck and totally destroyed by two volcanic blasts of nearly equal severity, occurring respectively on May 8 and May 20, 1902. The loss of life reached nearly 30,000 persons. The volcano of Mont Pelée continued in activity for a long time after these occasions. An eruption of May 28, observed by Mr. George Kennan, carried ejected matter up to a height estimated by Mr. Kennan as exceeding 12,000 feet.

It seems doubtful, however, whether the eruption of Mont Pelée and the nearly simultaneous one of Soufrière, on St. Vincent Island, produced a widely distributed haze in the atmosphere.

On the one hand the measurements made at the Astrophysical Observatory of the Smithsonian Institution on the transmission of the earth's atmosphere in 1901, 1902, and 1903 show that during the latter part of 1902 and the whole of 1903 the transparency of the atmosphere was very decidedly low—below the normal. On the other hand, however, a measurement of the total intensity of the solar radiation, made at this observatory in Washington on October 15, 1902, gives a value of the intensity of 1.40 calories per sq. cm. per minute, which is among the very highest observations of this kind which have been made at this station.

It is of course possible, though rather unlikely, that the haze due to the eruption of Mont Pelée was not so quickly distributed toward the more northern latitudes as that of Mount Katmai, in Alaska, in 1912, was diffused toward more southerly ones; so that perhaps the dust from Mont Pelée reached Washington later than October 15, 1902.

THE WHOLE SIDE OF THE MOUNTAIN BLOWN AWAY

On October 24, 1902, however, there occurred the eruption of Santa Maria, in Guatemala. The ashes from this volcano covered an area of more than 125,000 square miles. Pumice stone and ashes fell to a depth of 8 inches or more in a region extending over about 2,500 square miles, within which the houses and farm buildings were crushed under the weight of the ejected material and in some cases totally destroyed. Six thousand persons are believed to have been killed.

The cloud from the volcano reached 18 miles in height, and the sound of the explosion was heard at Costa Rica, 500 miles away. *The whole side of the mountain was blown away, exposing a cliff, nearly perpendicular, 7,000 feet in height and forming a crater three-quarters of a mile wide, seven-eighths of a mile long, and 1,500 feet deep.*

Photo by George C. Martin

OLD FOREST SPRUCE, WITH MOSS-COVERED TRUNK AND BRANCHES LOADED WITH ASH, NEAR KODIAK, SEPTEMBER 4, 1912

(See article by George C. Martin, pages 179-180)

XUM

Photo by George C. Martin

VIEW OF THE GARDEN AT KODIAK BAPTIST ORPHANAGE BURIED BY THE ASHES: WOODY ISLAND, JULY 27, 1912

The magnificent volcano of Colima, in Mexico (height, 3,960 meters, or 13,000 feet), had a period of great activity from February 15 to March 24, 1903, during which there were maximum eruptions on 12 days. In a photograph taken March 7, 1903, the column of ashes seems to reach a height of about 17 miles.

It is clear, I think, from these records that the decrease of solar radiation from 1888 to 1893 had much volcanic action to cause it, including Bandai San, Mayon, in the Philippines, Vulcano Island, and others; and that the depression, whose maximum was in 1903, was attributable to the terrific explosion of Santa Maria, in Guatemala, on October 24, 1902, reinforced by the later eruptions of Colima, in Mexico, of which a photograph is given on page 198.

DOES THE VOLCANIC HAZE PRODUCE COLD?

I have made some preliminary study to determine if the haziness produced by volcanoes causes a decreased temperature at the earth's surface.

Taking the year 1912, I find from the international ten-day mean values published by the German Marine Observatory that the high altitude stations of southwestern Europe, namely, Pic du Midi, Puy de Dôme, Brocken, Schneekoppe, Säntis, and Hoch-Obir, give a very marked indication of a decrease in temperature with respect to the normal beginning about the middle of July. The six stations I have named are very consistent with one another in this indication, and the following table, giving their mean result, shows the effect very clearly:

Temperature Departures (Centigrade), Mean of Six Mountain Stations, 1912.

Month	February.			March.			April.			May.			June.			July.		
Decade	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	Mean.
Departures	+0.7	+3.6	+5.9	+2.1	+0.7	+2.8	−1.0	−3.2	−0.9	+0.5	+2.8	−1.5	−0.6	−0.6	+0.6	−1.7	+2.1	+0°.69

Month	July.			August.			September.			October.			November.					
Decade	...	...	3	1	2	3	1	2	3	1	2	3	1	2	3	...	...	Mean.
Departures	...	...	−0.8	−2.2	−3.6	−2.1	−5.0	−4.4	−4.9	−2.6	−0.4	−0.3	−3.4	−3.6	−1.5	...	...	2°.68

Stations in our own country, however, are not so consistent. I have chosen some where the cloudiness is small so as to avoid that complication. The stations chosen are arranged in the following table with regard to whether their temperature departures* are increasingly negative after July, and thus support the indication of the high mountain stations of southwestern Europe, or not. It is interesting to see that Leadville and Flagstaff, which are both very high stations, fall in the first category.

*These departures are in Fahrenheit degrees

Station.	Jan.	Feb.	Mar.	April.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Mean.	
												1.	2.
El Paso	+1.6	−2.5	− 1.9	−4.7	−0.6	−1.8	+0.5	−0.8	−1.7	−0.2	−1.6	−1.65	−0.76
Pueblo	−3.0	+0.5	− 7.2	−1.7	+0.1	−4.0	−1.4	−0.1	−7.0	−0.9	+2.2	−2.55	−1.14
Dodge	−9.3	+0.9	−11.1	−1.6	+2.3	−5.0	+0.9	0.0	−4.2	+1.6	+4.5	−3.93	+0.56
Santa Fe	+0.4	−1.8	− 1.8	−5.3	−1.3	−3.8	−0.5	+0.2	−2.5	−1.0	+1.0	−1.93	−0.56
Leadville	+0.5	−2.0	− 0.6	−4.1	−0.5	−2.7	−2.2	−1.8	−7.2	−1.8	+0.2	−1.57	−2.56
Flagstaff	+1.6	+1.8	− 1.7	−4.0	−1.9	−0.9	−3.8	−1.6	−3.2	−0.9	+2.3	−0.85	−1.44
Tucson	+0.7	−1.6	− 2.9	−6.8	−2.4	+1.1	−5.1	−2.7	−3.6	−3.8	−0.9	−1.98	−3.22

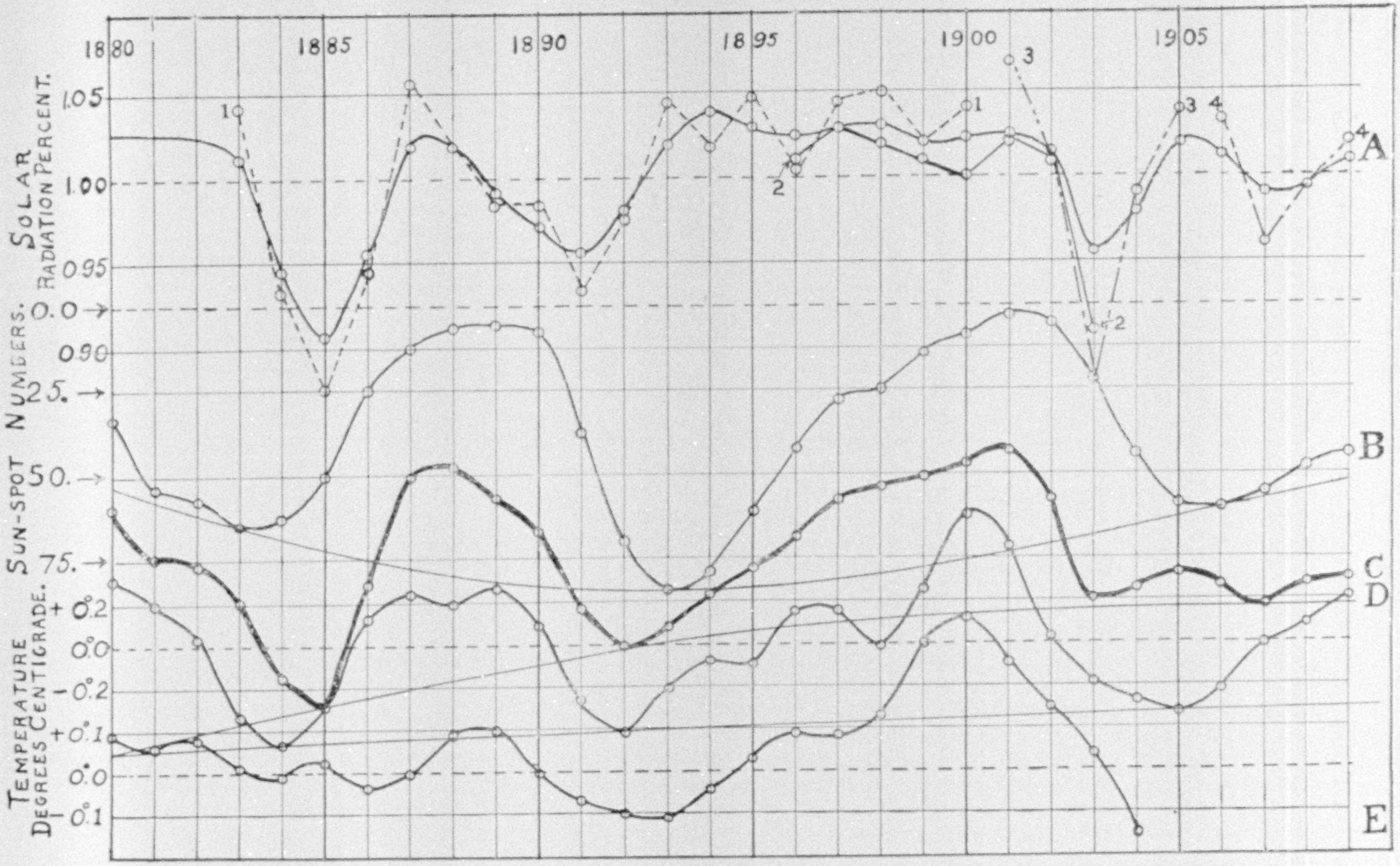

DIAGRAM TO SHOW VARIATIONS IN SOLAR RADIATION AND IN THE EARTH'S TEMPERARURE: 1880–1910

The periods of low solar radiation and low temperature coincide with periods when there was much volcanic dust in the air (see pages 191, 195, 197)

The volcanic effect, if here present, is certainly obscured by other influences.

As stated above, there seems to be a strong indication that the mountain stations were rendered appreciably cooler by the explosion of June, 1912. In order to see if a similar effect was caused by the dust cloud emanating from Krakatoa in 1883, I have studied the temperature departures for Pic du Midi, Puy de Dôme, and Schneekoppe for the years 1882 to 1884, inclusive, but there does not appear to have been at that time any such decrease of temperature following the eruption of Krakatoa, August 27, 1883, as occurred in July, 1912. Nevertheless at Pic du Midi there was a very well marked decrease in the daily temperature range, beginning with September, 1883. I have found for some other stations a similar decrease of the daily temperature range following the eruption of Krakatoa.

The fact is that the temperature of the earth is a function of so many variable quantities that general or cosmical effects are often greatly obscured by local ones. Studies have, however, been made by various authors to detect if there is a periodicity of terrestrial temperature corresponding in time to the sun-spot cycle of about 11 years, and it has been found by Koppen, Arctowski, Nordmann, Newcomb, Abbot and Fowle, and others that there is indeed an increased temperature at the time of minimum sun-spots. This increase of temperature is greater than would be caused directly by the darkening of the sun by sun-spots, so that it is supposed that there is accompanying the spots some secondary influence affecting terrestrial temperatures.

The fluctuations of temperature are, however, not fully accounted for by the march of the sun-spots, and I have endeavored to see whether a combination of the well-known effect of the sun-spot cycle with the effect of the volcanic haze will produce a more exact correspondence between the cosmical phenomena and the temperature of the earth.

Referring to page 196, the curve (A) is a smoothed representation of the average intensity of the direct solar radiation. The method of smoothing the curve is as follows, taking for example the year 1895: Add to the value for 1894 twice that for 1905 and that for 1896 and divide by 4. Curve (B) is the smoothed sun-spot curve as given by Wolfer. The sun-spot numbers run from 0 to about 80. Curve (C) is a combination of (A) and (B). They are taken in the following proportions: Multiply the percentage departure of radiation by 6* and subtract from it the sun-spot number for the given year. Curve (D) represents the departures of mean maximum temperature for 15 stations of the United States distributed all over the country. It is smoothed in the same manner as curve (A). Curve (E) represents the departures of temperature for the whole world, also smoothed in the same manner as curves (A) and (D). The data for the curves (D) and (E) are taken from Annals, Astrophysical Observatory, volume 2, page 192, and from the Monthly Weather Review of the United States Weather Bureau.

Although there is a considerable degree of correspondence between curve (B) and curve (D), yet it is not hard to see that there is also much of discordance.

For example, the sun-spot maximum of 1893 was greater than that of 1883 or 1906, yet the temperature curve (D) indicates a gradual increase of temperature for the three periods; also the temperature had begun to fall in 1890, although sun-spots were still at the minimum, and the temperature had begun to rise in 1892, although sun-spots had not yet reached their maximum.

Similar discrepancies occur in other parts of the curves, but when we compare the curves (C) and (D), that is to say, the combination of the effects of sun-spots and volcanic haze, with the mean maximum temperature for the United States, the correspondence of the curves is most striking.

CONCLUSION

It seems to me, in consideration of this, that there can be little question that the volcanic haze has very appreciably

* I incline now to think a better result would have come if 5 were used instead of 6.

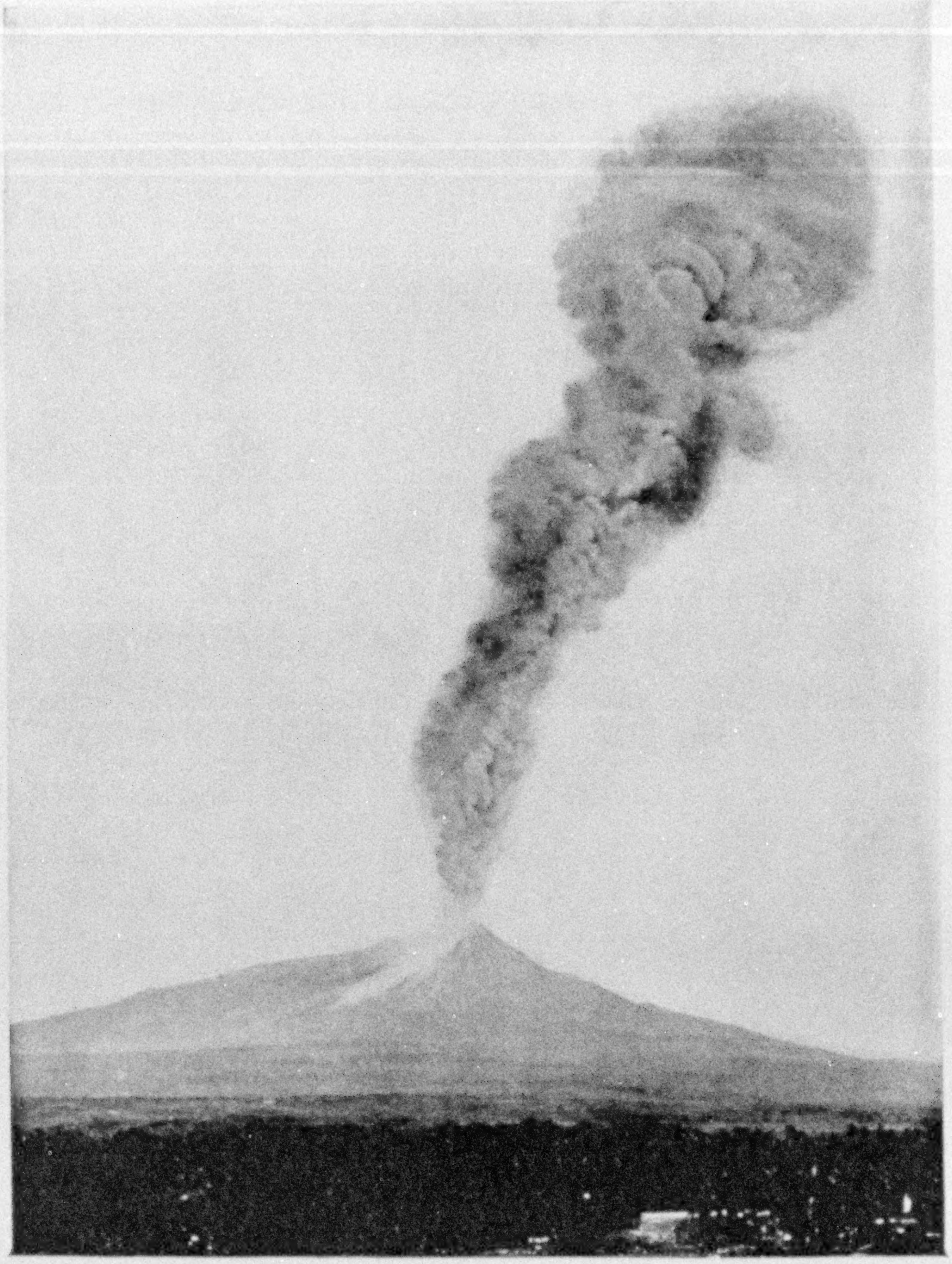

Photo by R. R. Rivera. By courtesy of The University of Chicago Press and the Journal of Geology

MOUNT COLIMA IN ACTION, MARCH 7, 1903

The column of ashes seems to reach to a height of 17 miles, or 89,760 feet. It is presumed that this notable eruption was largely responsible for the decrease in solar radiation noticeable in 1903 (see page 195).

influenced the march of temperature in the United States. When we take the march of temperature for the whole world the apparent effect is not so striking, but in this case there are so many conflicting influences at work that it is perhaps too much to expect so good an agreement.

In view of this slight preliminary study of temperatures, it seems to me that the question of the effect of volcanic haze on terrestrial temperature is well worth serious consideration.

Although a large group of stations may, by their contrary local influences, mask the influence of the haze, *I believe it will be found eventually that temperatures are influenced perhaps as much as several degrees by great periods of haziness, such as those produced by the volcanoes of 1883, 1888, and 1912.*

Certainly an agency capable of sending vast clouds of dust to a height of 20 miles in the air, there to be distributed by the winds all over the world, and to remain in suspension for months or years, causing the decrease of the direct radiation of the sun by as much as 20 per cent, is a climatic influence not to be ignored.

THE CHANGING MAP IN THE BALKANS

By Frederick Moore

Author of "The Balkan Trail," and Correspondent of the Associated Press

A VERY definite settlement of the centuries-old Balkan Question promises to result from the war which the "Allies" have been conducting against the Ottoman Empire. The Turk has been driven not entirely back to Asia but far enough in that direction to terminate his power over subject European races. This is the solution for which those European countries not materially interested in the maintenance of the Ottoman régime have long been hoping.

Centuries ago the Turks set out from Asia Minor with the idea of conquering the world for their Prophet Mohammed. They carried their new faith east into Persia, India, and China, and west into Europe. In Europe they succeeded in driving their way as far as the gates of Vienna, subjugating all the peoples of Southeastern Europe except some few bands of hardy Serbs who took refuge in the fastnesses of the mountains that now make up the little kingdom of Montenegro.

THE TURKS CONQUERED, BUT FAILED TO CONVERT

But though the Turks conquered and subdued with the sword they found the peoples of Southeastern Europe who followed the Christianity of that day most hard-headed and unconvertible. Had the Turks adopted the method of the Arabs, who went across North Africa on the same mission and even entered Spain, they would have left no soul alive who did not say with them

"There is no god but God, and Mohammed is His Prophet."

They did not desolate, however, to the same extent as the Arab; their method, though sufficiently terrible to blight the conquered countries and retard their progress for centuries, was never quite as drastic as the methods of other Mohammedans. The Turks are the best of the peoples who have accepted that uncompromising militant faith.

The territory which the Turks succeeded in overrunning was too vast to lay entirely waste and the people too numerous to exterminate. Those whom they could convert were made Mohammedans; the others became vassals and serfs, laboring for the conquerors, paying them tribute in money and in kind, and yielding up not only of their wordly possessions, as the Turk demanded, but also of their flesh and blood. Many of their daughters went at the Turks' will to Mohammedan harems, and for many years a tribute of their finest sons was also exacted.

In the early days of the conquest the Sultan's agents visited every four years the Christian villages under his domination and took away a fifth part of all the male children between the ages of six and nine, to be raised as Mohammedans and to form his corps of Janissary soldiers. Naturally, the strongest and finest boys were selected; however, being taken young, like many of the girls, no memories of parents or deep religious beliefs long affected them.

HOW THE TURKS IMPROVED THE RACE

By this system and by conversions (for many of the Christians went over to the new faith because of the privileges it offered, the foremost being the right to carry arms) the Turks added to their Semitic blood some of the finest manhood of the races of Southeastern Europe. Turks whose appearance is thoroughly European and Turks with fair hair and straight noses are to be distinguished throughout Western Turkey from the distinctive Semitic type; and some of the best brains in the recent Young Turk movement are European brains.

The infusion of European blood had a certain minor effect upon the character of the Turk, but the greater change came upon the converts and their offspring The blight of the Mohammedan creed, which impairs all better civilizations that it touches, affected the Europeans only

Photo by Frederick Moore

EASTERN GYPSIES, OR TZIGANES, WHO, LIKE ALL OTHER SUBJECTS OF KING PETER OF SERVIA, ARE REQUIRED TO CARRY ARMS

They had been called to the colors, but not yet uniformed when this picture was taken

Photo by Frederick Moore

SERVIAN SOLDIERS WEARING NATIVE PEASANT COSTUME, HAVING RECEIVED NO UNIFORMS WHEN THIS PICTURE WAS TAKEN

Photo by Frederick Moore

SERVIAN PEASANTS, CALLED TO ARMS, SIGNING THE MUSTER-ROLL

less seriously than it had the Asiatics whom it reached.

When Europeans became Mohammedans they became to all intents Turks and called themselves such; they were no longer Greek, Servian, or Bulgarian, as the case might be. In spirit if not in blood they were wholly gone over to the other race. Such is the power of the Moslem faith!

But the conversions were not on the whole large. The great majority of the Christians remained steadfast, and persecutions, as they generally do, made the people more than ever obdurate. And so we find the Bulgarians, Greeks, Servians, and Albanians of European Turkey today hard-headed people in spite of their centuries of oppression, not only retaining their own faiths, but wearing such clothes as they wore in the mediæval days when they were conquered, and speaking not Turkish, but Servian, Greek, Bulgar, Albanian, and, among the Jews who took refuge from the persecutions in Spain, the Spanish language.

SEVEN RACES IN ONE LITTLE CITY

All these people, clinging fast to their own ideals and marrying only in their own faith, remain today in remarkable distinction one from another, seven races sometimes making up the population of one small city, and remaining distinct in facial appearance, distinct in dress, distinct in language, and reverencing at least three distinct beliefs, with the Christian religion divided within itself.

The retreat of the Turks from the Balkan Peninsula has been comparatively rapid. Gradually, sometimes unaided, sometimes with the assistance or entirely by the efforts of one or more of the great Powers, the conquered Christian peoples have regained their independence. The modern States of Rumania, Greece, Servia, and Bulgaria were carved in the past century out of the conquests of the Turk, and Montenegro, always independent, was given definite boundaries and recognition.

Slowly the question of Turkey in Eu-

Photo by Frederick Moore

ASIATIC TURKISH TROOPS IN OLD ZOUAVE UNIFORMS, SOCKS PULLED OVER TROUSERS, DRILLING

Notice physiognomies of these as compared with European types of Turks

rope had been narrowed down, until at the beginning of the present war the provinces of Albania, Macedonia, and the Adrianople vilayet (known in ancient times as Thrace) composed all the European territory remaining under the domination of the Sultan.

There was no reason why the Balkan Allies could not have driven the Turks out of Europe ten, or even twenty, years ago, had they been able to agree upon the division of the territory and had they been bold enough to defy the dictation of Europe,—which has been anxious always to avoid the dangers of a conflict between the great Powers. But because there were Greeks, Bulgarians, and Servians scattered over European Turkey, each small State, unduly ambitious, preferred to let the years slip by in the hope of some turn of politics among the Powers that would work in its favor.

At last, however, the leading statesmen if not the masses of the people of the Balkan States set aside their jealousies and rival ambitions, and, coming to an agreement early in 1912, entered in a few months into the present war confident of success.

THE ALLIES FORCE THE ISSUE

They had always reason or excuse for war. The Turk had never seriously reformed; he had not assimilated the conquered people, nor had he done what has made the English powerful among foreign races over which they rule—he had not governed justly or well. In the case of each of the Allied States there were people of their own blood and religion just beyond their frontiers being constantly persecuted and massacred.

When the States were ready for war they made demands of Turkey which they knew the pride and arrogance of the Mohammedan, who had held them so long in subjection, could not accept. They demanded no less than the right of interference in the control of affairs in European Turkey, in order to put a stop to

Photo by Frederick Moore

TURKISH RECRUITS ARRIVING IN SALONIKI FROM ANATOLIA

the intolerable conditions under which their fellow-Christians were oppressed.

The Turkish people clamored for war, and the wiser heads among them understood that war was inevitable. Those wiser heads had come to realize that they were unable as a race to rule subject peoples except by the sword. They knew, too, that each of the Balkan States—and this was perhaps the most important factor—was ambitious to annex territory.

Underlying these motives of the Allies was a deep desire for vengeance on the Turk. There was not a Christian family in European Turkey whose property and hard-earned money had not at some time been taken by some Mohammedan; not a family without a record of parents slaughtered in massacre; not one which had not mourned a daughter enticed or taken forcefully to the harem of some lustful Turk. And what recourse was there for the Christians in a Turkish court of justice?

WAR THE ONLY SOLUTION

The situation was one that only war could settle. The Turks saw that to accede to the demands of the Allies would

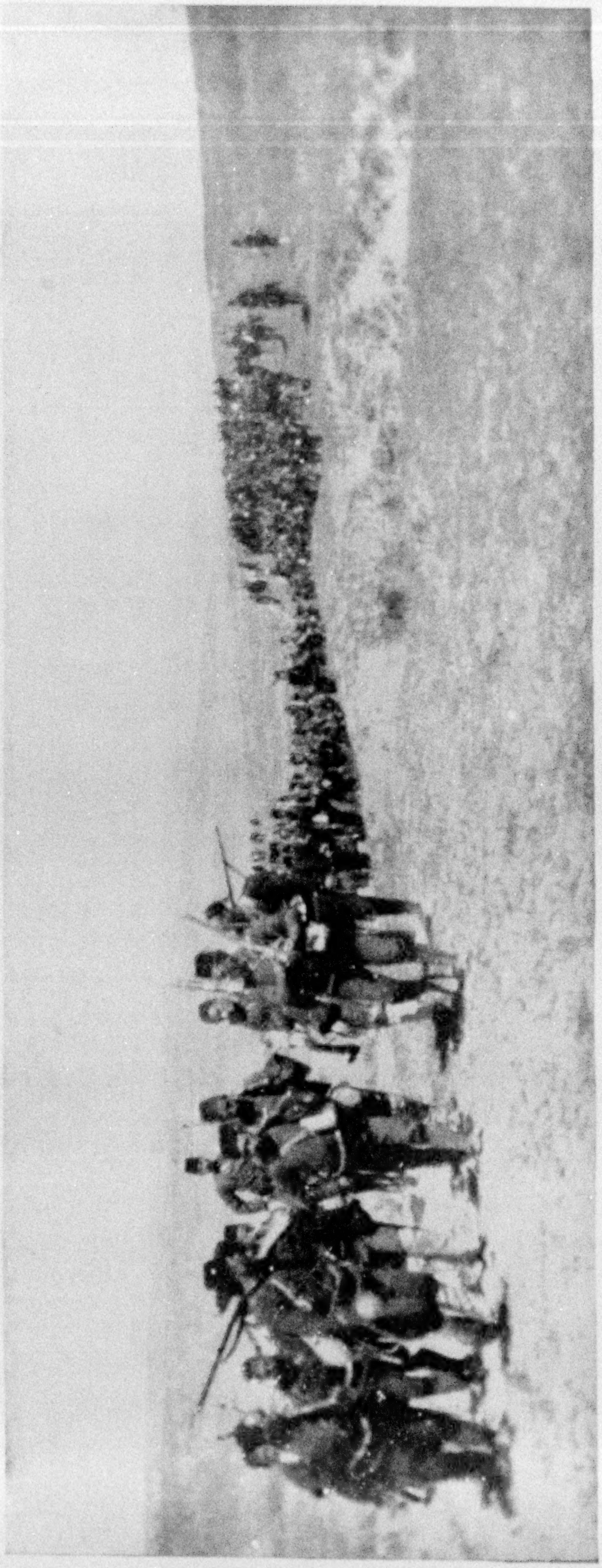

Photo by Frederick Moore

A SECTION OF THE TURKISH ARMY ON THE MARCH NEAR THE CHATALDJA LINES

be only to defer the day of trying the issue with modern arms.

If the Turks admitted European agents for the purpose of reforms within their own boundaries, and gave equal rights to Christian Bulgar, Greek, and Servian, they would soon be the subject and not the ruling people. Numerically the Christians of their European provinces outnumbered them and they were also quicker of wit. The situation was one of an inferior continuing to hold back several advancing races.

The Turks decided to accept war in place of the terms of the Allies. They were confident of holding the Allies in check if not of driving them back beyond their borders. Regiment upon regiment of recruits brought up from Asia Minor passed through Constantinople crying "On to Sofia!" And one of the Turkish newspapers boasted that in future years visitors to Bulgaria would cross the plain of Sofia and say, looking over a desert waste, "This was once the site of the Bulgarian capital."

Europeans generally, even military attachés located at Constantinople, believed with the Turks that the Allies would fall back before a terrible Turkish onslaught. Foreigners based their opinion on two things—on the name and reputation of the Turk as a fighting man and on the fact that the Greeks had been

Photo by Frederick Moore

CHOLERA VICTIMS THROWN FROM THE TRAINS WHICH CAME INTO CONSTANTINOPLE DAILY FOR WEEKS WITH SICK AND WOUNDED FROM THE LINES (SEE P. 215)

crushed by the Turks in battle not many years before.

THE ALLIES' SCHEME FAILS

When the Turks rejected the proposals of the newly Allied States of what they termed interference in their internal affairs, not all of the Allies declared war but only little Montenegro with her army of about 40,000 men—40,000 against the Turks' paper million!

In this preliminary declaration of war by Montenegro alone there must have been a strategical design on the part of the Allies. They evidently intended to draw a large part of the Turkish army off to the western extremity of the military area, thereby weakening the armies of Turkey that stood between the Bulgarian border and Constantinople and giving the Bulgarian forces the best chance of a successful rush, as they planned, upon the Turkish capital.

But the Turkish government, no doubt advised by their foreign experts, left the garrisons of Scutari and other Turkish towns in the neighborhood of Montenegro to take care of themselves and reinforced primarily the army that was to oppose the Bulgarians. The Turkish plan was apparently to defeat the Bulgarians first, and, having dealt with this most formidable of their enemies, to turn their attention later to the punishment of the other States.

But the Turks were not even equal to the first of the tasks they set themselves. They are a slow-moving race. I think it was Moltke who said that the Turks begin to defend a position only when another army would consider capitulating.

In the present war the Turk has shown a number of times how slowly he learns a lesson and how often he begins to act upon an experience too late. Nevertheless, as in the case at Chataldja and in the historic example of Plevna, he will defend too late with remarkable determination.

BULGARIA MAKES A RECORD IN MOBILIZATION

In the case of the Bulgarian, the army is a thing of speed and French-like dash. The Bulgarian officers, in preparing as they have for years for this war, devoured the history of Napoleon and planned to emulate his quickness of

Photo by Frederick Moore

DEFEATED TURKISH ARMY RETREATING FROM *LULIE BOURGAS* TOWARD THE CHATALDJA LINES

During this retreat the Turks suffered terribly. The weather was cold and wet, the roads muddy, and the commissariat gave out. Many soldiers threw away their arms and lay down in the mud to die of exhaustion and starvation

Photo by Frederick Moore

RETREATING TURKISH ARMY (AFTER THE DEFEATS IN THE THRACIAN PLAINS) CROWDING UPON AN ANCIENT BRIDGE

The retreat to Chataldja was a disorderly rout. Many officers left their men to save themselves as best they could. No discipline was preserved, and it was not until the line of forts was reached that the army recovered its morale

Photo by Frederick Moore

A SERVIAN KOMMITTADJI (BANDSMAN), THE CHIEF, VOIVODA PETKO

One of the Servian revolutionists of Macedonia who, after operating for years in Macedonia, finally served as guerillas in the present war.

camped behind the frontier mountains ready to move through the border passes on word from Sofia that peace was definitely broken.

Those who know something of the Turk can picture him at the front on receiving news that his own government had declared war against the Bulgarians and Servians, not waiting for those enemies to follow with Greece the example of Montenegro.

The news gave the Turkish soldier a measure of keen satisfaction. But, slow-moving and generally lazy, his camp was not stirred by the news as was that of the Bulgar. Slowly he gathered in little groups with his fellow-soldiers, knelt and gave thanks to Allah, made coffee and rolled cigarettes, and spent a happy night round a comfortable camp-fire discussing how he would make the Bulgarian girls dance to his music when he entered Bulgaria and the Bulgar men deserted their women and children to him.

But the Turk himself and not the Bulgar was the man who was going to hop and skip to get out of the way of the enemy. The Bulgars came through the passes with speed that amazed

movement. It was always said round the club in Sofia that when the Bulgarians struck their movement would be hard and fast against Constantinople. Consider how this little nation, with only about 3 million inhabitants, which the average American was wont to consider a primitive country of "Dagos," mobilized their army of 350,000 men. In two weeks after the call to arms their forces were

the military authorities of other nations, and, after three quick battles following rapidly upon each other, the Turkish army was driven back to the sheltering positions of the Chataldja lines, about 30 miles from Constantinople.

THE BULGARIANS AVOID THE TRAP

It was evidently the opinion of the Turkish generals, and also of the Ger-

Photo by Frederick Moore

ALBANIAN KAVASSES, DRESSED IN THE SAME "FUSTENELLA," OR PLEATED SKIRT, THAT THE NORTHERN GREEK WEARS

The Kavass is the armed watchman whom the foreign embassies or consulates keep to protect them and their residences in Turkey. Note their pistols

man engineers and military officers who had aided in the construction of the fortifications of Adrianople, that the Bulgarians would break their backs, so to speak, there at Adrianople, just as the Russians had spent so much of their energy and their time at Plevna in the war of 1877 before proceeding on to Constantinople. While the Bulgarians stormed and invested the position at Adrianople the Turks planned to bring up their great hordes of men—it would take several months, to be sure—from Asia Minor.

The Bulgarians, however, did not stop at Adrianople. Contenting themselves with masking the fortresses there with only sufficient men to prevent the garrison escaping or getting in further supplies, they pushed on at once toward their goal.

And what was the result of their getting to the Chataldja entrenchments within three weeks after they first charged the Turkish lines? The result was amazing; so terrific that almost any nation would have made peace without another battle and would have paid whatever indemnity the Allies saw fit to demand. But the soul of the Turk is of a different stuff. His religion is not a thing that considers seriously a waste of this world's flesh and blood.

The Turks had had in all probably 400,000 armed men scattered over European Turkey, yet they could muster on the Chataldja lines but 70,000 effectives for the defense of Constantinople. The others are to be accounted for in various ways; some had been killed in battle, some had died or become ineffective by starvation and disease, some had been

Photo by Frederick Moore

GREEK KILTED SOLDIERS, THE SPECIAL BODY-GUARD OF THE KING OF GREECE

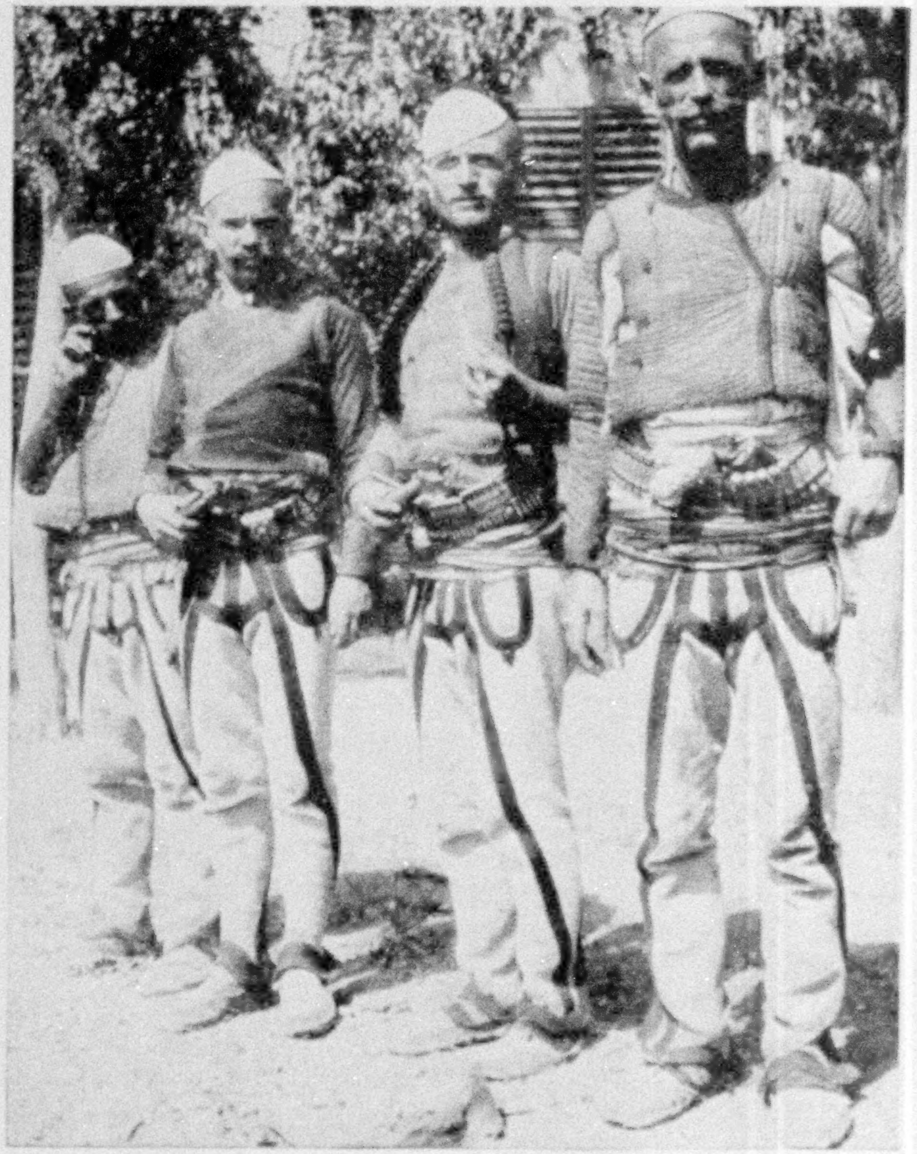

Photo by Frederick Moore

ALBANIAN BRIGANDS

Released from prison in one of the "general amnesties" which the Turkish government was wont to declare with ridiculous frequency under Abdul Hamid, who was often almost as lenient as he was severe.

Photo by Frederick Moore

PART OF THE TURKISH GARRISON OF MONASTIR MOVING OUT OF THE CITY (IN A FORMER CAMPAIGN)

made prisoners by the armies of the several Allies, some had been locked up in garrisons like those of Adrianople, Jannina, and Scutari, which must in time capitulate, and others had been cut off from retreat and compelled to take to the fastnesses of the mountains.

CHATALDJA AN IDEAL PLACE FOR DEFENSE

Yet with these 70,000 men the Turks were able to hold their position at Chataldja. There they began to fight. In this cramped position the Bulgarians were no longer able with swift movements to outflank them. The sea on either side and the heavy guns of Turkish cruisers confining the attack to a limited central plain, permitted the Turkish soldier to occupy his trenches and redoubts and fire steadily from them at the oncoming Bulgarian infantry.

It is a question whether the Bulgarians, now that the London conference has failed and fighting has been renewed, can succeed in taking the Chataldja lines. Their capture seems possible only by a slow tedious mining and trenching process; in other words, only by laborious and sacrificing effort such as the Japanese devoted to the taking of Port Arthur.

The questions have often been put to me why the Turks did so badly in this war and whether they are no longer the capable warriors they were in former days.

My opinion is that the reputation of the Turks as a whole rests upon the heroic work of a few ardent leaders,

Photo by Frederick Moore

ONE OF THE WEALTHIEST CHRISTIAN TOWNS OF INTERIOR MACEDONIA, KRUSHEVO, WHICH WAS DESTROYED BY THE TURKS WHEN SUPPRESSING A CHRISTIAN RISING SEVERAL YEARS AGO

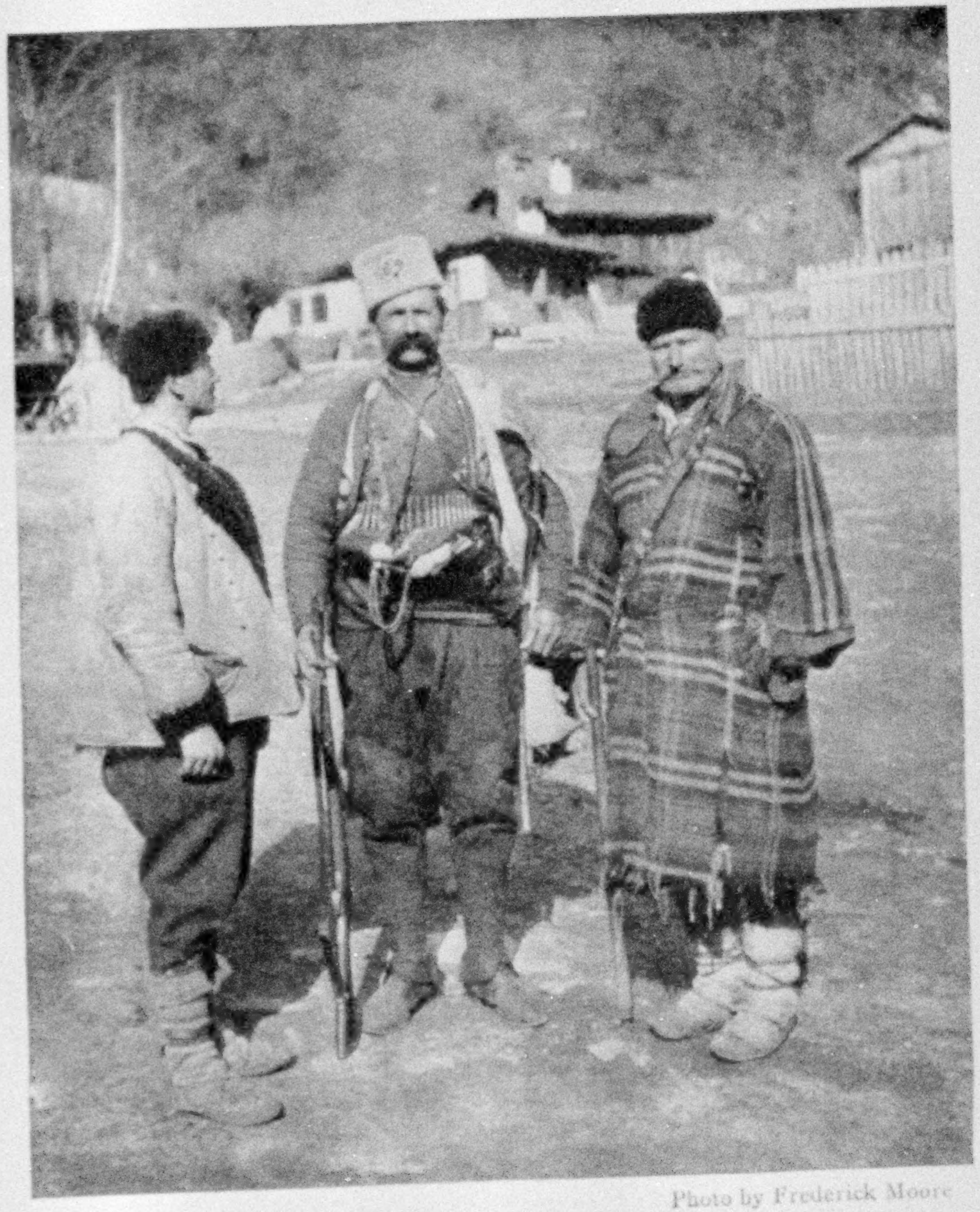

Photo by Frederick Moore

TYPES OF BRIGANDS OR BULGAR MACEDONIAN INSURGENTS WHO FOR YEARS KEPT UP A REVOLUTION AGAINST THE TURK, TILL AT LAST THE ALLIED STATES CAME TO THEIR ASSISTANCE AND DROVE THE TURKS OUT OF EUROPE

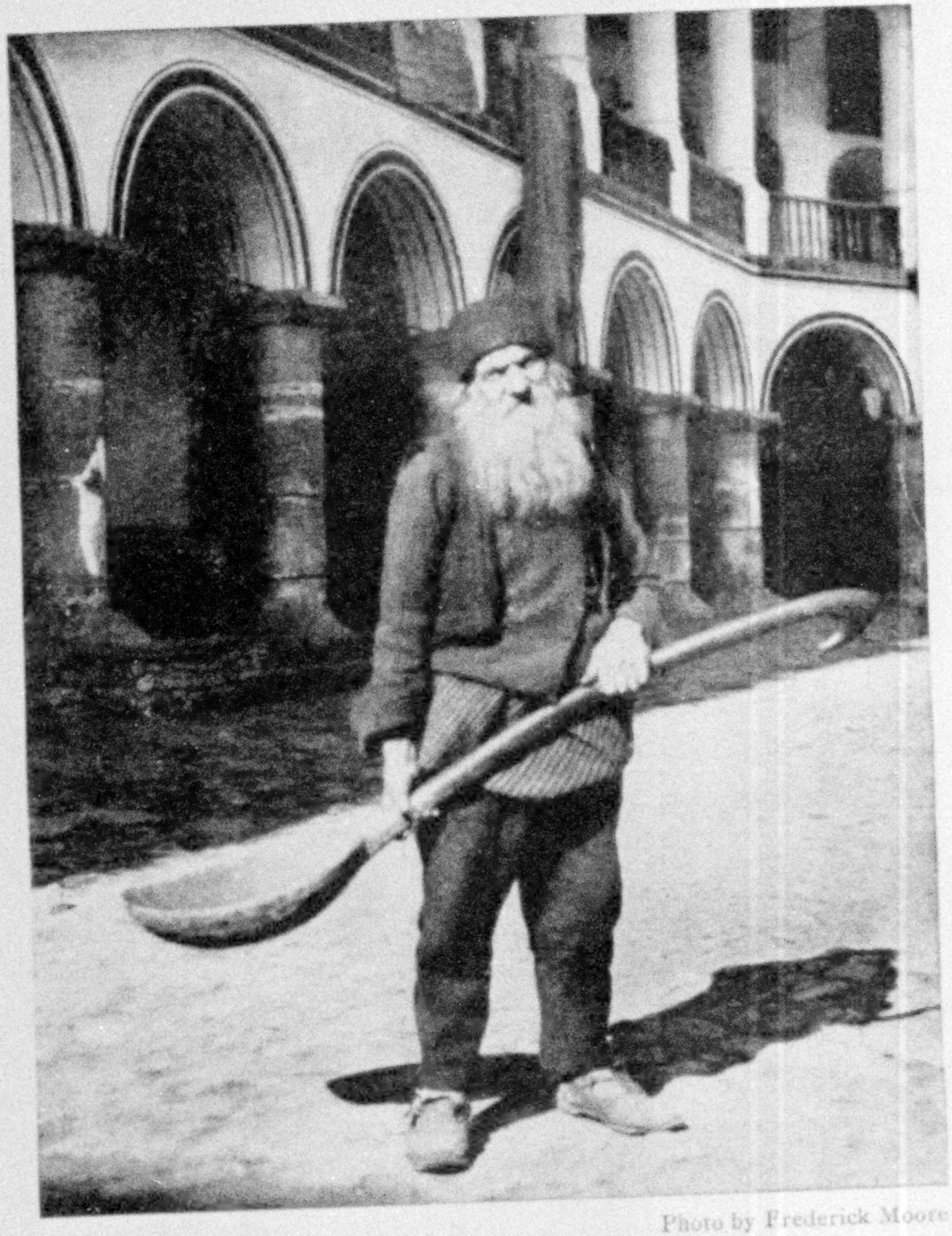

Photo by Frederick Moore

THE OLD COOK OF RILA MONASTERY, IN BULGARIA, WHO, DURING PILGRIMAGES TO THIS SHRINE, SERVES OUT SOUP TO EACH FAMILY FROM A HUGE CALDRON WITH THIS GREAT WOODEN SPOON

Photo by Frederick Moore

MONTENEGRIN SOLDIERS ON THE HEIGHTS ABOVE THE AUSTRIAN COAST

partisans of the faith, who encouraged and employed the spirit of Islam, which the great majority of the ignorant people of Turkey possess. Some of the Turks fight well—as, for instance, at Adrianople, at Scutari, and at Jannina—and some do not.

The trouble rests with the organization of the Turkish government, which is so incompetent and corrupt that no standard of fighting efficiency can be maintained. If any one army or single garrison fights well it is because that garrison is properly controlled and led.

THE REASON WHY THE TURK HAS FAILED

As a whole the nation cannot and will not, because of internal political jealousies, work in unison, work zealously and honestly. The killing of Nazim Pasha is a case in point, and also the memorable delinquency of the palace clique in ignoring persistently the appeals of Osman Pasha, the commander of Plevna, for relief and reinforcements in 1877. Many of the Turks would rather see the enemy win than that their political rivals should hold office.

As this war has brought out, there are great defects of organization in the Turkish army. Whole regiments, for instance, were sent to the front during the mobilization with few or no officers, the officers joining the men in the camp or even on the battlefield.

In former days, as, for example, at Plevna—as no doubt in Adrianople, Scutari, and Jannina today—men and officers shared the hardships in common, suffered together, and sympathized one with another. Too many officers of the new school, who reside mostly at Constantinople, do not know their men, and are consequently mistrusted by them.

Photo by Frederick Moore

ON THE (FORMER) TURKO-BULGARIAN BORDER: A BRIDGE OVER THE RIVER STRUMA, THE CENTER OF WHICH WAS THE BORDER LINE; A TURKISH SOLDIER ON THE LEFT AND A BULGARIAN ON THE RIGHT

The foreign-educated officer of the present day spends too much of his time in the cafés and the foreign restaurants of Pera, and too little in the camp of his soldiers.

I saw on one occasion a young Turkish doctor, immaculately dressed, wearing a high collar on the field, refuse to touch a line of 20 or 30 invalided men because they were too dirty for him to handle. To my knowledge these men had had hardly sufficient water to drink and no opportunity whatever to wash.

THE HORROR OF THE CHOLERA CAMPS

Conditions in the cholera camps—which I had occasion to describe in my dispatches to the Associated Press during the month of November—were final proof, if proof were needed, of the hopeless incapacity of the Turks. There is a measure of excuse even for massacres, Mohammedans believing that they do not offend God by slaughtering "infidels;" but could there be any excuse for permitting thousands of their own soldiers to die without taking the trouble to give them water?

The scene at San Stefano was horrible almost beyond conception. For weeks train-loads not only of sick but wounded men and men with frozen feet were dumped down at this summer watering place on the Marmora. Those who were able to walk entered the cordon of death without assistance; those unable were

Photo by Frederick Moore

MARKET DAY IN A MACEDONIAN VILLAGE, SHOWING TURKS AND GYPSIES AT THE HORSE FAIR

Photo by Frederick Moore

SWEARING TO A BARGAIN

Being unable to write, men who buy and sell ponies or other animals are sworn to a bargain (over which they shake hands) by a third man

pushed off the cars and lay where they fell, or rolled down the steep railway embankment some 20 feet or more to the level ground. For a fortnight or several weeks practically no attention was paid to the victims put into this camp.

On my first visit to the place, in the company of Mr. Hofman Philip, first secretary of the American Embassy, and Major Clyde S. Ford, of the United States Army, there were probably eight Red Crescent men standing idle among the dead and dying, who lay huddled together in groups on the open ground, endeavoring to get, by close contact, what shelter they could from the winter winds.

We saw one man praying, whose overcoat blew over his head, he was too feeble to replace it, and yet the men who wore the Red Crescent did not trouble to help him. They did not trouble to place a stone under the heads of many who might have been more comfortable for even so hard a pillow.

The victims lay, that first day of our visit, on the hard, cold ground for the most part, unsheltered even from the wind. There were not more than a dozen tents and they were crowded with corpses and men who would soon be corpses. In one tent Major Ford counted twenty-two. The Red Crescent men shrugged their shoulders as we approached, as much as to say, "What can any one do?"

Occasionally a water cart would pass, a barrel on wheels drawn by a pony or donkey, and the driver would call out "su!" Those who were able to rise and respond to this cry of water got a little. They fought and fumbled for it, men sometimes falling in the mêlée. Those who wanted bread and could respond when the call came of "ekmek" went likewise to the cart and got it for themselves.

I saw one man at a deep well trying, evidently, to wet the end of a long sash which he had unwound from his waist in

Photo by Frederick Moore

HIGH UP ON THE MOUNTAIN CITADEL OF USKUB, WHERE THE WEEKLY MARKET OR FAIR IS HELD

From Uskub the Turks fled without making a stand before the Servians; their departure from their post of duty was, in this case, in marked contrast to their determined stand in Adrianople and on the Chataldja lines

order, I suppose, to moisten his parched lips. The water cart did not come his way.

THE TURK REFUSES AID FOR HIS OWN WOUNDED

Several men lay on a manure pile, in which one was feebly digging with his fingers a trough in which he might lie and thus keep warm. Several round this manure heap lifted their heads and called out to us in Turkish. Our kavass (an embassy attendant) told us that they said, "We are sick men and no one gives us water and no one gives bread." Their appeal to us in the sight of men of their own faith seemed to me a remarkable recognition of a somewhat better condition of humanity existing among men of the Christian nations.

There was no excuse for this terrible condition, which existed not only at San Stefano, but on the Chataldja lines and even in Constantinople. The government had brought the cholera over to Europe from Asia Minor in the mobilization, and then brought it into Constantinople, where sick and wounded were crowded into the mosques. At Constantinople there was an abundance of provisions and an endless supply could be got in from the several seas that wash the Empire's shores. There were also many foreign Red Cross volunteers in the city, who were not permitted to go to the front!

The Turk likes to conduct his affairs or leave them to conduct themselves without the interference of foreigners, and though always polite he availed himself of the foreign medical officers and nurses only when they forced themselves upon him. In order to get patients some of the volunteer surgeons were compelled to meet the incoming trains and take away as many wounded men as they could accommodate in hospitals which they improvised.

The condition at San Stefano was so pitiful that Mr. Philip and Major Ford, together with the Rev. Robert Frew, a Scotsman, and Mr. Maurice Baring, an Englishman, went out there with the idea of saving at least some of the wounded and injured who were not stricken with cholera. Mere segregation and feeding and watering hundreds of those cordoned at San Stefano would save their lives.

The work which these men took up was financed by Mrs. Rockhill, wife of the American Ambassador, with American Red Cross funds and other collections. Soon the Turks, shamed at the sight of foreigners doing their work, sent out a few officers and a number of men and made a feeble pretense of medical work, and soon foreign Red Cross men and some Austrian Sisters of Charity went out to assist at the work.

TWO HEROIC WOMEN

But the pioneers of all were two old women, one Swiss, the other a Hungarian, both frail old ladies of more than sixty years, whom Philip's party on their arrival found already working among the mass of dying and dead humanity. These old ladies, governesses living in San Stefano, went into the cholera cordon, taking their own savings of money and working with their own hands, not even troubling to notify the foreign embassies of their action, much less appealing for protection. Miss Alt and Madame Schneider were the names of these ladies.

THE DILEMMA OF THE YOUNG TURKS

The Young Turk movement, which promised much a few years ago, seems doomed to failure. The original leaders of this reform movement were men affected by European education—almost entirely men who had lived, if they had not also studied, abroad. The majority had returned home with their faith in Mohammed distinctly shaken.

But though they had lost their zeal for the creed of Islam their sojourns abroad had not made Christians of them. Against their natural enemies, the Balkan States, they were as bitter as ever. Their religion had given place to patriotism. Instead of replying in the manner of the "true believer" to the question of their nationality, namely, that they were Moslems, they would answer now, if you inquired, that they were Ottomans.

Photo by Frederick Moore

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Photo by Frederick Moore

STREET SWEEPERS IN SALONIKI

The White Tower in the background is where the ancient pre-Turkish wall, probably built by the Crusaders, met the sea

They succeeded, as is well known, in overthrowing the Sultan Abdul Hamid, whose tyrannical régime bore only less heavily upon Turks than upon Christians.

Having come into power (in 1908) they were faced with the problem of the faith: Should they denounce Mohammedanism or support it?

They tried a middle course, attempting to give to Christians and Jews equal rights with their own people. This impossible combination naturally failed.

There is now left to them the alternative of supporting or denouncing Mohammedanism. By continuing that faith as the soul of the empire they maintain a stifling idea, a state of mind that cannot progress sufficiently to keep pace with the advancement of the countries which, being "infidel," all true followers of the Prophet must scorn and oppose.

On the other hand, should the Young Turks attempt and succeed in destroying the Mohammedan faith—a thing they will not do—the result would be the break-up of the Empire, for Arabs, Syrians, Anatolians, Kurds, and others are bound to the Turks only by the "faith," and because the Sultan at Constantinople is their Caliph, their religious chief.

It is regrettable that though the Balkan question is solved and the people of European Turkey liberated, there still remain many Christians, notably the Armenians, in Asia Minor, for whom independence or even a measure of relief seems impossible. That these Christians of Asia Minor will suffer further, as a result of the present war, there seems little doubt.

THE AMBITIONS OF BULGARIANS

The Bulgarians have now by conquest come down to Ægean Sea. They speak already of the navy they intend to build,

Photo by Frederick Moore

WALLACHIANS (OR KUTSO-VLACHS, AS THEY ARE KNOWN IN MACEDONIA), ONE OF THE SEVEN DISTINCT RACES OF MACEDONIA

The people whose blood affinity with the Rumanians gives Rumania excuse for claiming territorial compensation for their annexation by Bulgaria

planning to have ships in both the Black Sea and the Ægean, and thereby controlling if not possessing the great waterway that joins these two seas. A glance at the map will show what a splendid position the Bulgarian army as well as the navy will hold in any future war that may arise with Turkey.

In offering back to Turkey, as the Bulgarians did at the abortive London conference, a sufficient strip of territory to connect Constantinople and the Darda-

Photo by Frederick Moore

BULGARIAN PEASANT GIRLS ON THEIR WAY TO MARKET IN SOFIA

Photo by Frederick Moore

SLAV PEASANTS OF BOSNIA IN THE AUSTRO-HUNGARIAN EMPIRE

nelles, they gave evidence of a desire to keep out of the high politics of Europe. By occupying the coveted city of Constantinople and the Dardanelles—that is to say, all of European Turkey—the Bulgarians would at once enter the sphere of politics which causes the Great Powers to form into two balancing groups in order to maintain the peace of Europe. The Bulgarians seem, curiously, to have little ambition to hold the city, which, as one of their leading statesmen first pointed out to me, has caused the ruin and downfall of every empire that has possessed it.

The Bulgarians, unlike the Greeks, are not dreamers and have no imperial aspirations. They are very hard-headed, as every student who has written of them has declared. Even more than the

MAP OF THE BALKAN STATES

Photo by Frederick Moore

THE TURK GOES OUT OF EUROPE AS HE CAME

Long lines of these arabas pass daily over the bridges of the Golden Horn and are conveyed to the Asiatic shores by boat

Servians and the Montenegrins, who are likewise Slavs, they are most practical.

WHAT THE SLAV QUESTION MEANS

When we take up the Slav question we enter at once into the politics of Europe. Why have the European Powers the right to interfere in Balkan affairs?

It is in the first instance the right of might; but most of the Powers have also very definite reason or excuse.

England, the supporter of the Turks in former years, aided them then because the alternative of their occupation of Constantinople seemed to be an occupation by the Russians; and England, in spite of the present *entente* with France and Russia, has never ceased to guard against the Russians achieving their ambition to acquire an outlet to a southern sea.

As is well known, England's permanent policy in European affairs is to maintain a divided continent in order that she may remain supreme. She is always to be found balancing the rival European camps, thereby keeping the peace by placing her navy on the side of the weaker group. Hostile to Russia prior to the Japanese war, she now forms the Triple Entente by supporting the Franco-Russian Alliance, the Triple Alliance of Germany, Austria-Hungary, and Italy being, she believes, the present danger to European peace. Hostile to Russia when Russia's ambition was to possess Constantinople, England is now hostile to Austria-Hungary and her supporter, Germany, who together apparently covet the possession of Saloniki and hope for the extension of a German shaft of territory from the Baltic Sea to the Ægean.

England is well satisfied that the Balkan States are victorious in the present war, though she opposed them when she feared that they, being Slavs like the Russians, would eventually be annexed by Russia. But the three Slav States of Southeastern Europe have given very clear proof to the contrary, and as long as they desire their own liberty of action and independence Great Britain will allow her Christian sympathies to support those minor States against the Turks.

WHY AUSTRIA INTERVENES

The position of Austria-Hungary, supported by Germany in her interference on behalf of the Albanians, is one of serious politics as well as of thwarted ambitions. The evident intention of the victorious Balkan States was to divide Albania—an important territory, though peopled only by a primitive mountain race and more or less sparsely settled. But the accomplishment of this plan would unite the Montenegrins and the Servians, on the south of Austria, within whose borders are many Slavs.

Austria-Hungary desires to keep any confederacy of the Southern Slavs feeble, because though these Southern Slavs intend to maintain their independence, they are, nevertheless, in sympathy with Russia, the great Slav nation, whose religion, like their own, is Orthodox—that is to say, of the same form as the Greek.

The great balance of racial power in Europe being Germanic and Slav, the Germanic Powers must prevent a strong Slav confederacy south of them as long as their northern frontier is permanently open to a Russian menace. Furthermore, by maintaining an intact Albania, which Austria will support and assist for political purposes, she may prepare for the future absorption by herself of this section, at least, of Turkey in Europe.

IS RUMANIA'S CLAIM JUST?

It is because Rumania is not Slavic, yet lies geographically between Russia and the Southern Slavs, that she naturally adheres in sympathy to the Germanic Alliance. Rumania's claim for territorial compensation from Bulgaria is based on the fact that many settlements of Rumanians, not emigrants from Rumania, but remnants evidently of ancient Roman invasions of the Balkan Peninsula, will be annexed by Bulgaria with her share of the conquered territory of Macedonia and the Adrianople vilayet.

With the new order of things that must come soon after the several countries are able to mark out their new border lines and extend their respective governments, the various scattered settlements of Bulgars, Serbs, Albanians, Greeks, and perhaps even Rumanians (or, as they are known in Macedonia, Vlachs) will naturally, to some extent, shift themselves behind the respective border lines of the races with which they are to become assimilated.

The Tziganes, or gypsies—of whom there are very many—will be content to live anywhere, and there will be no difficulty of politics or national ambitions arising from their presence.

Likewise, there will be no difficulties save those that exist already in Balkan countries, with the Spanish Jews, who, as I have said, took refuge in Turkey in great numbers during the period of persecution in Spain.

THE TURK FORCED BACK TO ASIA

As for the Turk, he will trek back in great numbers to Asia, selling out his lands for what he can get or allowing them to be taken from him, for there is much vindictive feeling among the Christians. He will dispense with the question of compensation—being a fatalist—as the will of Allah.

He will make his way back to Asia as he came away, centuries ago, little changed by his association with the people of Europe—whom he has kept as he found them, in a medieval condition, with all the barbarity of medieval Europe, with all its picturesqueness, its color, squalor, and unthinking faith.

The Turk is to be seen already moving toward the Bosphorus. Many thousands went away, fleeing before their retreating army, leading their double teams of buffaloes or oxen, behind which creeped the lumbering, four-wheeled arabas, laden with the remnants of their possessions, and with their veiled women in black and their children gaily clad in striking contrast.

Will the Turk change now, and progress and reform? That is a question which I should answer in the negative. He is a Moslem, and the soul of the true Moslem is indifferent to progress.

But for the enlarged Balkan States it seems safe to predict rapid development along modern lines, for we have seen how all of them under great difficulties have already fulfilled partially, at least, their aspirations to adopt the civilizing institutions of Europe and to advance in education, morals, and material welfare.

THE COUNTRIES OF THE CARIBBEAN

By William Joseph Showalter

THE wonderful changes that will be wrought on the countries of the Caribbean region by the completed Panama Canal are beginning to be evident through the plans these countries are making to capitalize on the advantages it brings to them. Everywhere there is anticipation that the completion of the canal is going to bring in a great stream of capital for development purposes, and that an era of unprecedented growth and expansion will result.

Such a desirable outcome will take place in some of these countries, but not in all of them; for, until capital is made safe in any country, it will not come in, and there seems to be no prospect of such an issue of affairs in many of the countries of this region.

Nowhere else in the world has Nature been more bountiful in her blessings of natural resources than in the Caribbean region. Everything that her treasure-house holds has been bestowed with lavish, and also with impartial, hand. Some one has observed that if you tickle the ground with a hoe it smiles back with a yam, and certain it is that in any one of these countries the ground of natural resources may be tickled with the hoe of foreign capital and it smiles back with yams of wealth.

These countries are nearly all favored alike in natural wealth, but there is a vast difference in the development of that wealth—a difference that may be attributed almost wholly to the character of the governments in the respective countries.

POVERTY AND MISRULE DWELL TOGETHER

In some of these lands the milk and honey of plenty flows in a bountiful stream. Others are in wretched poverty, where the masses never have enough to keep the gaunt wolf of hunger from gnawing at their vitals day and night and year in and year out. In traveling through these countries one is impressed with the fact that prosperity abides with good rule and poverty dwells with misrule.

Starting out with the easily demonstrated fact that there is very little difference between these countries in their natural resources, it is interesting to look around and notice what a vast difference there is in the use that is being made of this natural wealth. One needs not go out of the confines of Central America to see this. It would require six Salvadors to make one Honduras, and yet Salvador has three times as much population and three times as much foreign commerce as Honduras.

Costa Rica is less than half as big as Nicaragua, and yet it has three times as much foreign commerce as Nicaragua.

And yet, when Salvador and Costa Rica are compared with Porto Rico, they in turn seem to be slow in their development. Porto Rico is so small that seven islands like it would be required to cover an area equal to that of Costa Rica, yet it has a foreign trade five times as great as that of the Banana Empire. Porto Rico is less than half as large as Salvador, yet it has a foreign trade seven times as great.

WHY LITTLE PORTO RICO HAS PROGRESSED

Little Porto Rico is so small that it could be buried in a single Central American lake; it would take 57 islands of its size to equal Central America in area, and yet Porto Rico produces more foreign trade than all Central America together from Tehuantepec to Colombia. The reason? Because Porto Rico has an ideal government. The trade of the island has nearly quintupled since Uncle Sam took possession there. The number of children enrolled in school has increased sixfold. The wages of the laboring class has multiplied threefold.

We read of Porto Rico's present prosperity in every page of the record of its expanding industry. It is seen in the sugar fields, where four tons of sugar are produced where one was a dozen

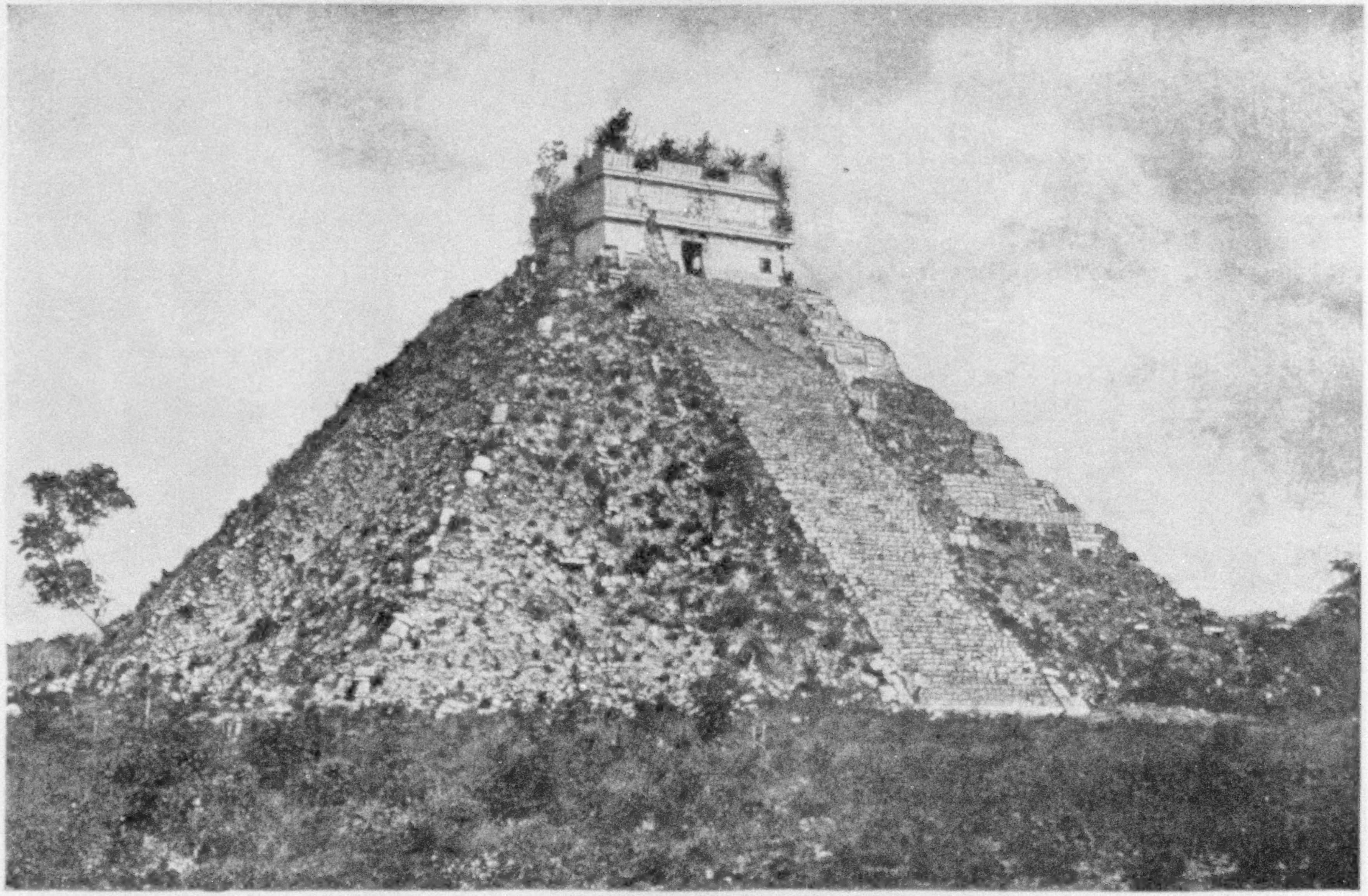


Photo from W. H. Holmes, U. S. National Museum

THE PYRAMID TEMPLE OF EL CASTILLO, YUCATAN

This is one of the finest pyramid temples in all Mexico. It is 80 feet high and 200 feet square at its base. It fronts a little east of due north and has stairways on all four sides. The walls of the temple which occupy the apex are 3 feet thick and are of plain masonry, but the pillars and portals are covered with sculpture in relief. A curious, warlike, human figure and colossal serpent heads are frequently repeated in the scheme of decoration, and the temple was possibly dedicated to the war god of the Itzas.

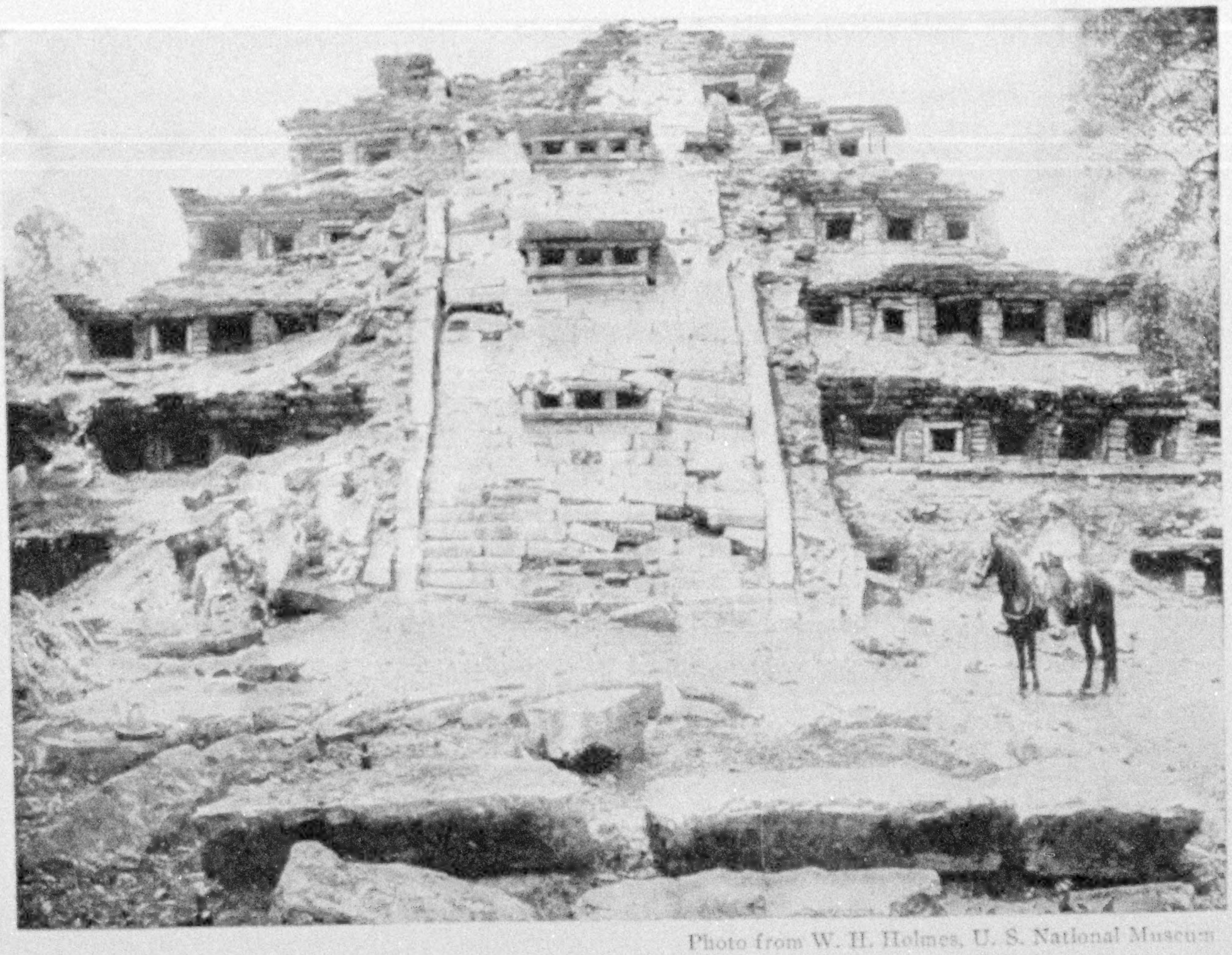


Photo from W. H. Holmes, U. S. National Museum

THE PYRAMID TEMPLE OF EL TAJIN

This pyramid temple, situated at Papantla, in the province of Vera Cruz, Mexico, presents a feature found in no other pyramid. It is constructed of earth, dressed with stone, and is solid throughout. With the exception of the space reserved for the stairway, the pyramid is faced on all four sides with a series of stone niches apparently designed to receive statues. This feature is unique. The temple proper, which crowned the pyramid, has now disappeared.

years ago, and where the Porto Rican people receive $6 for exported sugar where they received $1 only a dozen years before. It is seen in the expansion of the coffee fincas, where production has quadrupled since the beginning of the century. It is seen in the growth of the fruit-export business, where the production of oranges increased sevenfold in ten years, pineapples twenty-fold in four years, and grapefruit twenty-five-fold in three years.

Wherever one turns Porto Rico is extending its sugar fields, planting new pineapple plantations, establishing new coffee fincas, and laying out new citrus-fruit groves. And given a free entrance of their products to the markets of the United States, products raised where frosts never threaten and where labor is abundant and cheap, Porto Rico is destined to become a great competitor with Florida and southern California in supplying our tropical and semi-tropical fruits.

The crusade which was initiated and originally directed by the U. S. medical officers against the hookworm disease in Porto Rico has been a godsend to the suffering people of the island. Formerly practically the entire population of Porto Rico suffered from this wasting affliction. Hundreds of thousands of cases have since been treated and the majority of them cured. Forty-five dispensaries are maintained throughout the island, and in a single year 49,000 cases have been treated, out of which 19,000 complete and 7,000 partial cures were made. There still remain some 200,000 cases in the

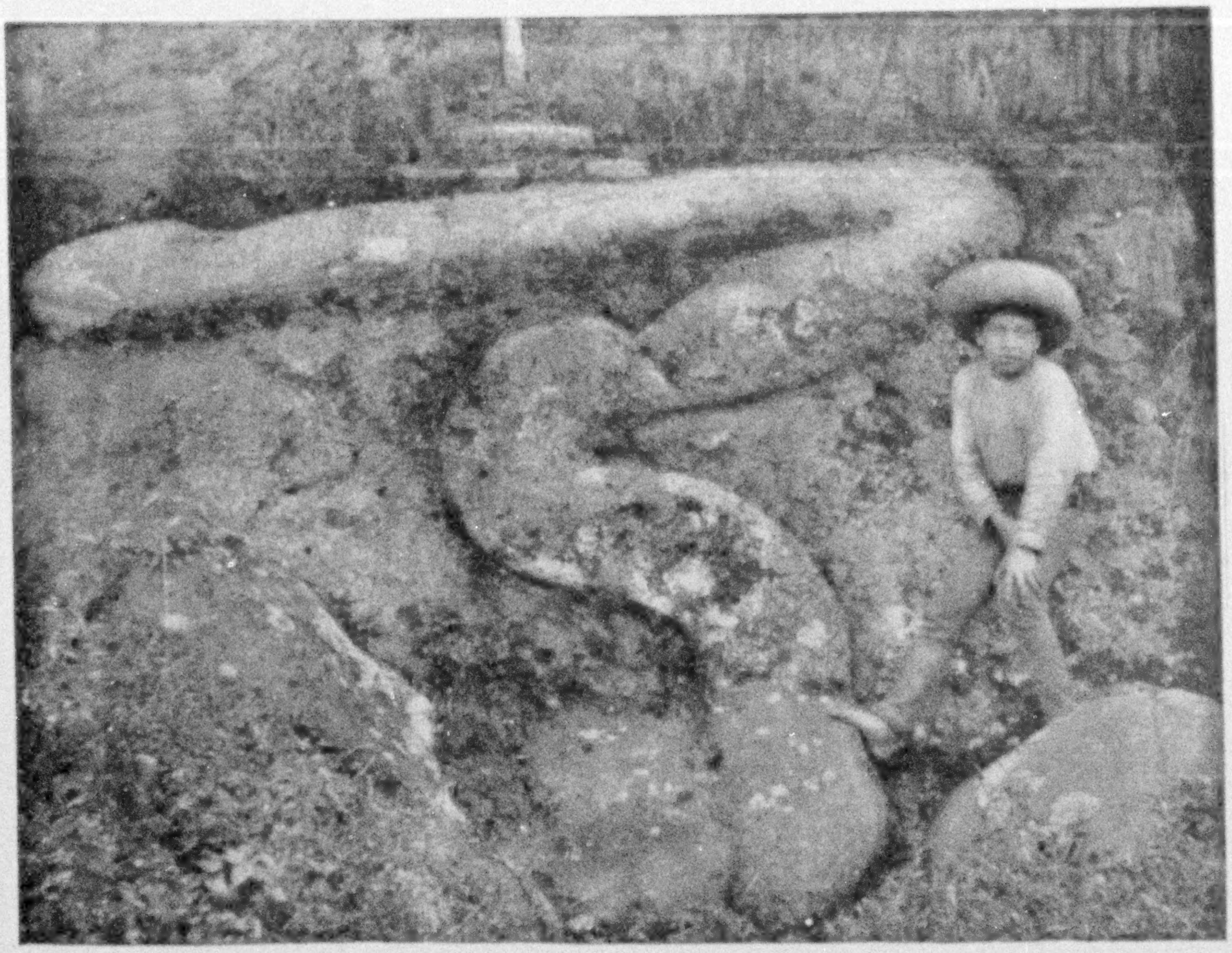


Photo from W. H. Holmes, U. S. National Museum

A PREHISTORIC WATER GOD

This enormous serpent is found sculptured on the rock on a hillside near the town of Fuente, in Mexico. It is represented as if crawling out of the spring, which here issues from the rocks. It is 20 feet in length and its tail is hidden in the spring. Archeologists are of the opinion that it represents a Mexican water god.

island, but they are being reduced at the rate of about 12,000 a year. The treatment is free to the people, the expense being borne by the government.

With hundreds of thousands of men, women, and children released from the thralldom of one of the most wasting and preying diseases that may attack the human system, humanitarian ends without measure have been served; and, with their earning power doubled, their ability to work in many cases trebled, the great crusade against the hookworm in Porto Rico constitutes one of the brightest pages in all colonial history. Here public medicine has been put to the test, and the most enthusiastic promises of the sanitarian and exponent of preventive medicine has seen his dreams come true.

A TERRIBLE PICTURE

That Porto Rico under Spain was little different from Central America today is shown by a prize-winning essay that was published at the big centennial celebration of 1897—an essay that was awarded the prize by the Spanish authorities on the island themselves. In that document the essayist declared:

"Only the laborer, the son of our fields, one of the most unfortunate beings in the world, with the pallid face, the bare foot, the fleshless body, the ragged clothing, and the feverish glance, strolls indifferently, with the darkness of ignorance in his eyes. In the market he finds for food only the rotten fish or meat, codfish covered with gangrenish splotches, and Indian rice; he that harvests the best coffee in the world, who aids in gathering into the granary the sweetest grain in nature, and drives to pasture our beautiful young beef animals cannot carry to his lips a single slice of their flesh; coffee is to him a prohibited luxury, and he can use only sugar laden with impurities."

Photo from W. H. Holmes, U. S. National Museum

A REPULSIVE IDOL

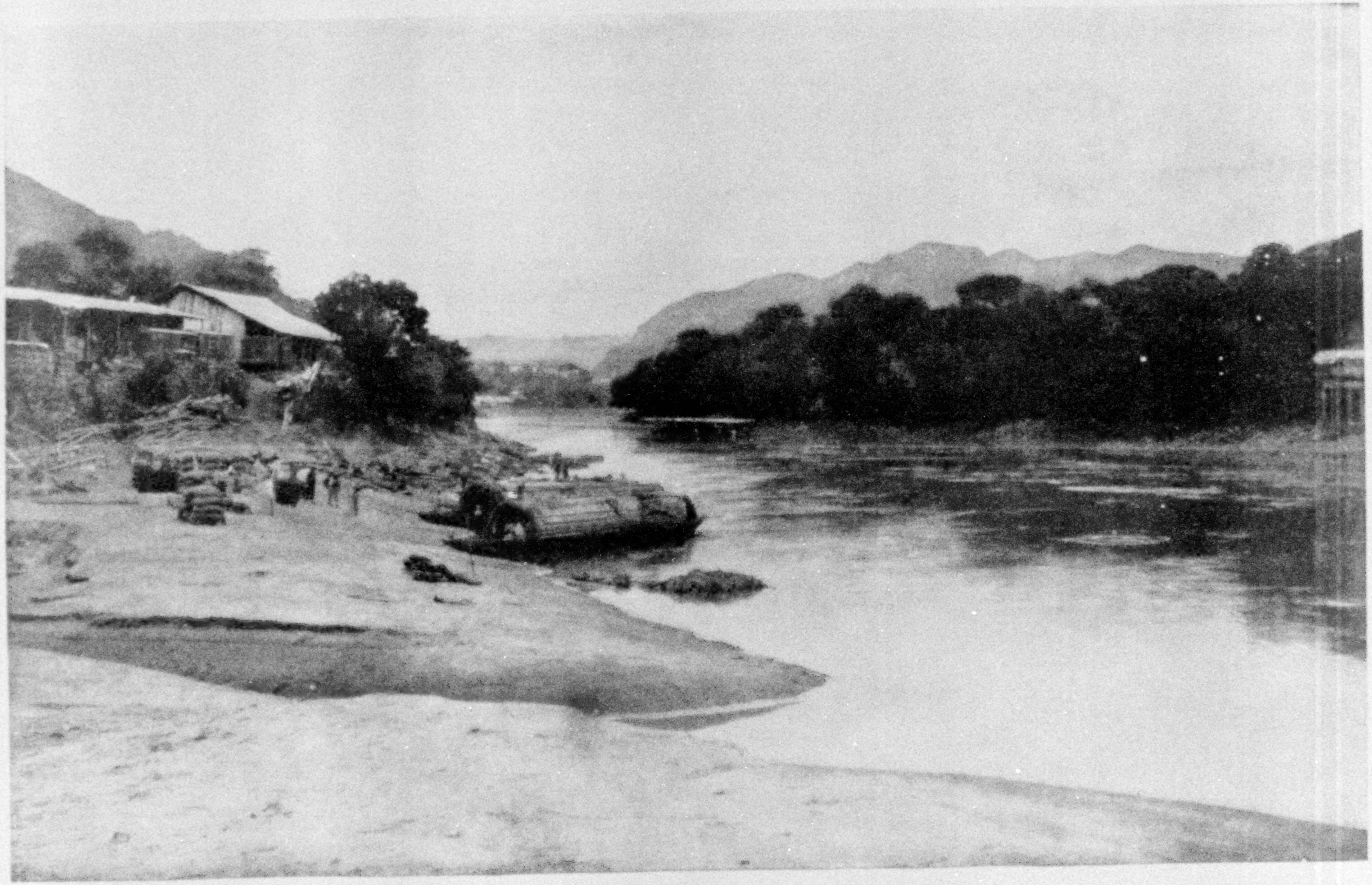
This curious stone was found in a corn field a few hundred feet from the station at Xico, in Mexico. An animal figure with a human head is carved in high relief on the boulder to which it seems to be clinging. Some idea of its size can be gained from the little Mexican boy who is shown alongside it.

The picture which then fitted Porto Rico now fits Central America. The laborer of Porto Rico, who then got less than 20 cents a day for his work, was even better off than the present laborer of Guatemala, who now gets nine cents a day for his. Then, seven out of nine Porto Rican laborers were barefooted; today nine out of ten wear shoes, while in Central America six out of seven are barefooted.

Lest it seem to appear that in comparing Porto Rico with Central America the comparison is an unfair one, let Cuba be taken instead. Cuba has an area somewhat smaller than Guatemala and a population approximately equal, and yet it enjoys a foreign trade 13 times as large. It has an area one-fifth as great as that of all of the six Central American republics, including Panama, and yet its foreign commerce is three times as great as that of all six republics together.

GOOD GOVERNMENT SPELLS PROSPERITY

Jamaica, a British possession, has an area only one-twelfth as great as that of Nicaragua, and yet it has a foreign trade three times as great. One might go on with these enumerations indefinitely, the lesson of them all being that prosperity cannot exist where good government does not. On the other hand, it is equally demonstrated that poverty cannot exist in the Caribbean region where good government is found.



SCENE ON THE MAGDALENA RIVER, COLOMBIA — Photo from Mrs. Harriet Chalmers Adams

The Magdalena River is the chief highway between the interior of Colombia and the sea. It is a very rapid river, and its navigation is difficult, but river steamers ply regularly as far as Honda, about 600 miles from its mouth. There navigation is interrupted by a series of rapids; but a railroad has been constructed along the banks which permits merchandise to be transported to the upper reaches of the river, which are navigable for a considerable distance. The total length of the Magdalena is about 900 miles, and its mouth is obstructed by a delta.

GUATEMALA

A trip through the countries of the Caribbean is a trip of remarkable contrasts. In some ways Guatemala is the most interesting of them all. Guatemala contains a larger proportion of pure-blooded Indians than any other of the republics.

In northern Guatemala one sees many tribes of Indians who have never felt the rude touch of an outside civilization. They are not even acquainted with Spanish, and still speak the uncorrupted tongues of their Aztec and Mayan ancestors who ruled the country before Columbus discovered America. They are an honest and cleanly race. They will not tolerate loose women among them, and in their transactions with outsiders their word is as good as old wheat in a granary.

A little illustration of this it was my good fortune to see when I was in Guatemala City with Secretary Knox. Indians from every part of the republic were compelled to go to the capital and participate in the big parade. While calling on Consul General Bucklin, a Mrs. Owen, who has spent 30 years among them, brought in two typical San Cristobal Indian girls to be photographed. One of them had a very unique set of native-wrought silver ear-rings, which I bought from her, and also a silver ring surmounted with a little spread-winged dove. Then she had another ring which I thought was a hand-carved gold one. She replied that she would not sell it, since it was not gold. Mrs. Owen assured me that she has never known one of them to misrepresent anything in order to effect a sale.

Yet it is these splendid types of people who become slaves to the Guatemalan coffee planters and are forced to work their lives away trying to pay their debts on a wage of less than nine cents a day.

WHAT AN AMERICAN CORPORATION DOES FOR THE INDIANS

It is in Guatemala that one begins properly to appreciate the great civilizing influence of a much-maligned American corporation—the United Fruit Company. That corporation has many thousands of acres of banana plantations along the lowlands of the Motagua River and extending to the Caribbean Sea. It pays its laborers a dollar in gold a day, eleven times as much as the laws of Guatemala say shall constitute a day's wage. One readily can imagine what a boon this is to poor Indians who have formerly been paid only nine cents. Yet the United Fruit Company voluntarily pays this wage, and is able to give work to every Guatemalan Indian who applies for a job.

It is the advent of such organizations as these—powerful enough to protect their own interests when disputes with the local governments arise—that spells the economic salvation of these countries and promises an honest wage to the laboring classes. I hold no brief for the United Fruit Company, but it must be said that that great corporation has done more for Central America than all other agencies combined.

HONDURAS IS VERY UNFORTUNATE

Honduras is in a very bad way from whatever standpoint one views it. It has a smaller population now than it had a half century ago, and it has gone to wreck and ruin to such an extent that nothing but outside help can ever lift it again to a plane where growth and development are possible. And yet it is rich in natural resources almost beyond imagination.

With vast deposits of minerals of all kinds; with untold thousands of acres of the finest tropical fruit and vegetable lands in the world, and with vast areas of magnificent grazing and coffee lands, Honduras is at our very doors. It is 700 miles nearer to Chicago than that city is to San Francisco; it is closer to Washington than Denver is; it is farther from New Orleans to Chicago than it is from Puerto Barrios and Livingston to New Orleans. A stable government for Honduras, and it must become a kingdom of plenty instead of a principality of poverty!

A KINGDOM OF PLENTY

Across the border is prosperous little Salvador. It is as different from Honduras as night is from day. It has a population so dense that if ours were of

PILE DWELLINGS ON LAKE MARACAIBO

Photo from Mrs. Harriet Chalmers Adams

It is to these pile dwellings that Venezuela owes its name. When Alonzo de Ojeda, the explorer, arrived on its shores in 1499, these Indian villages, built then, as now, on piles, reminded him of Venice, which is also built on piles, and so he called the country Venezuela, or "Little Venice."

Photo from Mrs. Harriet Chalmers Adams

LAKE MARACAIBO, VENEZUELA

This is a great lake, quadrangular in shape, in western Venezuela, 137 miles long and 75 miles broad. It communicates with the sea by 13 channels, each obstructed by a sandy bar, but for which the lake would be navigable for large vessels. The influence of the tides is felt in the lower part of the lake, and the water is consequently brackish, but in the upper half the water is sweet. A city and seaport, founded in 1571, of the same name stands at the entrance to the lake.

equal density we would have a population of 700 million in the continental United States; and although nearly half of the country is mountainous, the people are able to get their living out of what they produce and still have a balance of trade amounting to about $3,500,000 a year.

The Salvadorean people are different from those of any other Central American State. They have a middle class. There are thousands of little farms not much larger than a good-sized city block, and yet it is here that the real prosperity of Salvador is created.

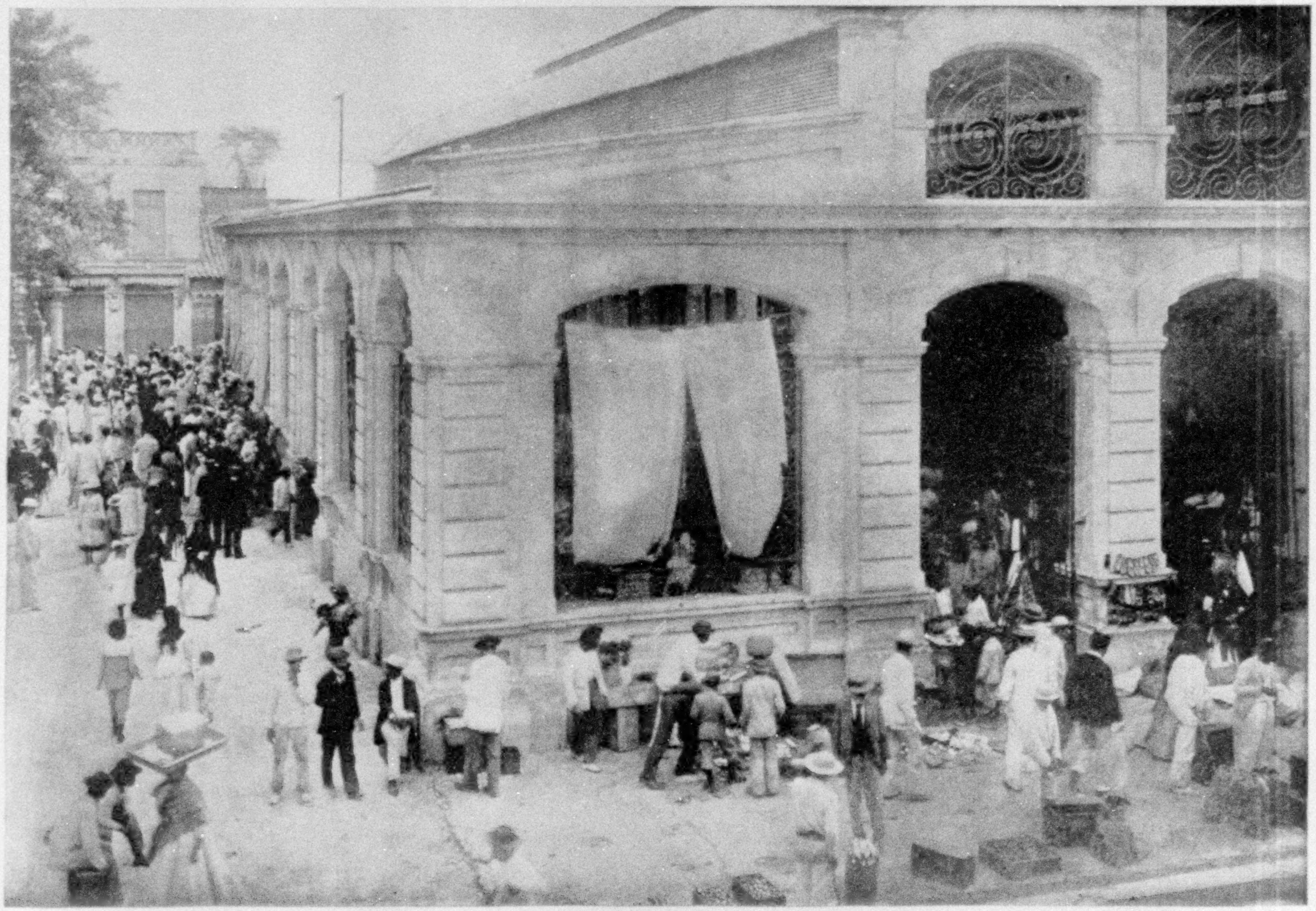
In no other way could nearly 2 million souls find subsistence on 7,225 square miles of territory, nearly half of it mountains. Salvador has had its revolutionary troubles, too; but they have been more because of bellicose neighbors than because of internal difficulties. People who cultivate their own lands have too much at stake to start a revolution with every change of the moon.

THE HOPELESS NICARAGUANS

Nicaragua is in the same condition as Honduras. They have had revolutions there since the memory of the inhabitants runneth not to the contrary. There seems to be little hope that they will ever be able to give themselves a good government. Here one sees a thousand opportunities for the development of great wealth.

Virgin forests of all the precious woods in the category extending for miles on end; coffee lands where millions of pounds of splendid coffee might be grown; sugar lands which might yield hundreds of thousands of sacks of sugar; and yet all stand idle. Why?

Ask the American coffee growers of the Matagalpa district; ask the cotton growers of Campo Santo. The revolu-



THE PUBLIC MARKET AT LA GUAIRA — Photo from Mrs. Harriet Chalmers Adams

La Guaira, as the chief port of Venezuela, has a considerable trade, being visited by about 300 vessels a year. Its chief exports are coffee, cocoa, indigo, and sugar. For nine months in the year La Guaira suffers from the heat, which is often excessive, and this, combined with the lack of sanitation, occasions malignant epidemic fevers.

Photo and copyright by The Keystone View Co.

WATCHING THE STEAMERS ENTERING PORT: LA GUAIRA, VENEZUELA

La Guaira is the chief port of Venezuela. It lies in a valley surrounded on three sides by high mountains. It is an unattractive town. The streets are narrow and badly paved, and the houses ill-built. There are, however, a few fine public buildings and some handsome churches. A winding railroad connects it with the capital—Caracas—some 23 miles distant.

tions come along and leave their coffee to spoil ungathered and their cotton to go to waste unpicked. Ask the financier from New Orleans who spent 20 years of hardships there trying to gather together a competence, and who now finds his business wrecked and in the hands of receivers.

Given good governments, then no countries on the map would afford greater opportunities for profitable investments than those of Central America. With such governments as some of them now have, all their natural wealth cannot offset the disadvantages of those governments, and an investment at 4 per cent in the United States is often to be preferred to one yielding 100 per cent in some of these countries.

A CENTRAL AMERICAN REPUBLIC WHERE THEY DO NOT HAVE REVOLUTIONS

When we come to Costa Rica things are beginning to be different, and Costa Rica does not like to be reckoned in the same class with Nicaragua, Honduras, and Guatemala. She has not had a revolution in a generation. The country is

Photo and copyright by The Keystone View Co.

STREET SCENE IN CARACAS

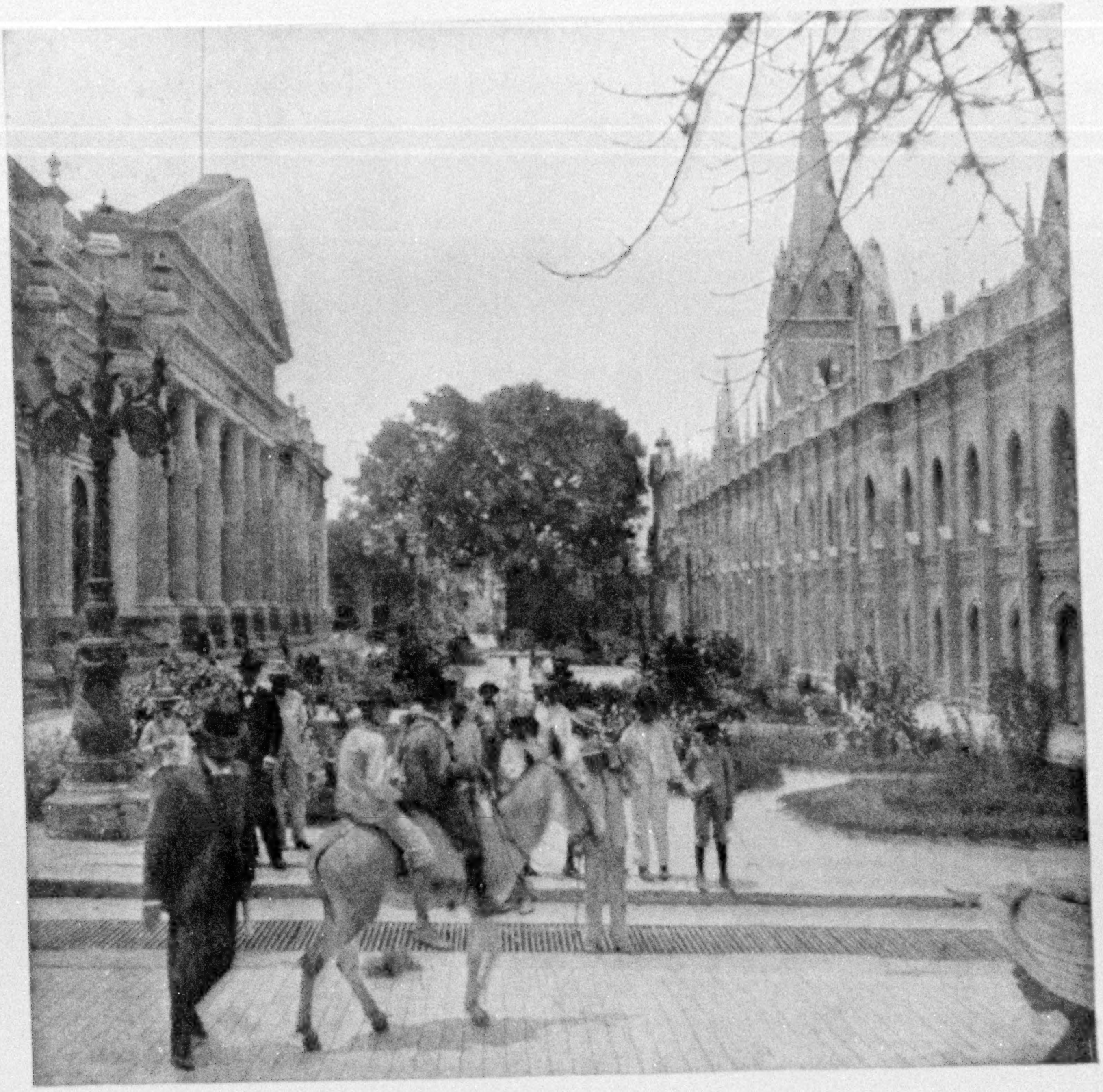
In the towns of Venezuela the most fastidious can always be certain of the freshness of their milk. It is the custom to conduct the cow in person, often accompanied by her calf, to the door of the customer, and the operation of milking is performed in the presence of the purchaser.

so occupied with foreign interests that everybody is busy and revolutions are not to be thought of, much less started.

Panama is blest with some very fine farming and fruit lands in the region next to Costa Rica; but nearly all of the Panamans have gone down to the canal zone region for the time being. Some of the most beautiful *tierra templada* lands in America are to be found in the Chiquiri country, and when the people of the United States get acquainted with the possibilities there, some of them are going to settle in that region and make it a splendid example of the possibilities of tropical America.

It is not improbable that one of the results of the completion of the Panama Canal will be the realization by the people of the United States that its safety depends in no small degree upon the good conduct of the governments of Central America. That will mean a demand for a new order of things in these countries, which in turn will mean safe investments for American capital.

Then will dawn an era of development and expansion in Central America com-



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A HANDSOME PLAZA IN CARACAS, VENEZUELA

The Plaza Bolivar is the center of Caracas, and contains the cathedral, the archbishop's palace, and the national library. The streets cross each other at right angles, are all numbered, lighted by electricity, and generally well paved. The city was founded in 1567, and was almost entirely destroyed by a great earthquake in 1812.

parable to that which has taken place in Porto Rico and in Cuba.

NEW YORK TO PANAMA BY RAIL. IS IT A DREAM?

Then will the Pan-American Railroad become a living reality instead of a statesman's dream. Already, in anticipation of that day, Panama is preparing to build from the canal to the Costa Rican frontier.

The gap to the Costa Rican Railroad is not a long one, and the connection through to Nicaragua would not be difficult to build. From the national railway of Nicaragua to the one now being built by the United Fruit interests from the lower part of Salvador through to a connection with the Guatemala Northern is only a short break, and then there would be actual rail connection from Panama to New York.

Of course the idea of through trains or even through cars is little more than a dream, since the roads are of varying gauges, and it will be many a year before it can even be hoped that they will all be converted to standard gauge.

Photo and copyright by The Keystone View Co.

CARACAS, VENEZUELA

This city, the capital of Venezuela, occupies a beautiful site in a narrow valley at the foot of the mountains, at a height of some 3,000 feet above the sea. Dominating the city are the twin peaks of the Silla de Caracas, which rise to the height of 8,622 feet. The climate of Caracas has been described as one of perpetual spring, with an annual mean temperature of 66 degrees; but there are very rapid changes, and the alternation of the dry and humid winds is often very unpleasant.

As it is, it is now possible to travel from Washington to the Guatemalan frontier on a standard-gauge road; but who does it once will never do it again.

The trip across the great Mexican desert is an experience not soon forgotten or desired again. With the windows of the Pullman cars down as if going through a tunnel, still the alkaline dust seeps in and makes the traveler feel that he has been in the presence of a threshing machine for 24 hours.

TWO OF THE MOST WONDERFUL RAILROADS IN THE WORLD

If Central America expects to capitalize on the building of the Panama Canal, it has no more ambitious hopes in that direction than Venezuela and Colombia. Although Colombia is still deeply aggrieved over her failure to negotiate a canal treaty with the United States, that does not prevent her from expecting much benefit from the operation of the

Photo from Mrs. Harriet Chalmers Adams

VIEW ON THE ORINOCO RIVER, VENEZUELA

This great river, which is approximately 1,500 miles long, and is supposed to have 436 tributaries, has never been properly explored, although in the days of the Spanish conquistadores it was the scene of many voyages of discovery in search of El Dorado. It flows into the sea through a delta which is 700 square miles in area, and so little above sea-level that great tracts of it are periodically flooded. The influence of the tides can be seen in April, when the water is lowest, as far up the river as Ciudad Bolivar, 373 miles from its mouth. Although it presents a magnificent waterway, the Orinoco is but little used for steamboat traffic.

big waterway. Already thousands of concessions are being issued, and Colombia, practically virgin territory so far as development is concerned, promises to be invaded by a great army of men whose mission it will be to convert her latent wealth into usable money.

Venezuela considers herself a sort of natural stopping place for travel that passes through the Panama Canal. With two of the most wonderful railroads in the world, leading from La Guaira and Porto Cabello to Caracas, one of the most charming of all the American capitals, it is certain that no place can hold out more attractions for the tourist.

On the one road the traveler must ride 23 miles to make seven, and that in itself tells a story of a wonderful mountain road, with zigzags and windings galore, with high bridges, gorges thousands of feet deep, and other touches of scenery not surpassed in its grandeur and beauty anywhere. On the other road there are 86 tunnels in less than 100 miles of railway, and it would seem that a third of the route was made up of bridges.

Caracas has a situation to be compared only to that of Mexico City. It has a climate such that no one has failed, it is said, to sleep under a blanket since the city was founded. If its climatic charms, its beauty, and the attractions of its society come to be fully appreciated, this will be one of the places to which the tourist steamers of the world will carry their passengers. Then there are millions of acres of splendid tropical farming land in Venezuela, and rich deposits of minerals and oil.

The West Indies also are getting ready for the great boom in international trade which the completion of the canal promises. The Danish government is prepar-

ing to spend millions of dollars in deepening the magnificent harbor at Charlotte Amalia, on the island of St. Thomas, expecting that here will be a favored spot for the calling of ships after the big waterway is in operation.

Lying hard by the main shipway from Europe to the canal and being a free port, St. Thomas anticipates a great boom. And it will almost certainly become the Panama-hat distributing center of the world. I have been in every country north of the Equator, and on this island I saw the biggest Panama-hat store I have ever seen. It is probably the biggest emporium of its kind in the world.

WHERE IS COLUMBUS BURIED?

Santo Domingo expects that it will get a share in the great international commerce that will move through the Panama Canal. Not only will it afford a great highway for its exports and imports, but will also constitute an important port of call for many kinds of ships.

Here one may see the house of Columbus, and if the conclusions of the priests of Santo Domingo are to be believed, his very ashes. It seems that Columbus, his brother, and his son were interred in the Cathedral. In after years it was decided to remove the ashes of the Discoverer to Havana.

When the Spaniards were fighting in the Spanish-American war they took the bones at Havana back to Spain and interred them there. It is claimed that it has since been demonstrated that those are the bones of his brother.

The Santo Domingans afterward opened up a leaden casket and in it found the inscription "Cristobal Colon, First Admiral." Other evidence substantiates the claim and was strong enough to convince Secretary Knox that the Dominicans actually do possess the real bones of Columbus.

The casket was opened for our party. There were small parts of the skull, vertebræ, ribs, and femurs remaining; but for the most part there was nothing but dust. The bones still remaining uncrumbled would fill about a quarter-peck measure.

UNCLE SAM AS A CUSTOM'S CLERK

Under the convention by which the United States is overseeing the collection of customs in Santo Domingo, remarkable results are being achieved. When the United States sent the receiver there, the customs collections in their entirety did not suffice to meet the needs of the government and the republic was a bankrupt, defaulting on its interest and having the warships of a European nation at its door.

One of the early acts of the receiver was to revise the tariff. Export duties were cut in two and import duties were lowered 14 per cent.

Under the old tariff champagne was admitted with a nominal duty and beer was heavily taxed; silks came in almost free and cotton goods bore a heavy burden; French sardines were admitted with a low duty and rice was assessed with a very heavy one. It put the burdens of taxation on the poor masses and practically exempted the rich classes.

The revised tariff reversed all this. And under an honest administration of the tariff laws 60 per cent of the reduced tariff gives the country more revenue than 100 per cent of the old tariff. The other 40 per cent goes to the liquidation of the foreign debt of the country.

Haiti does not expect much from the Panama Canal, for here is the one spot in the New World where black rules white, and to which the tourist tide will probably never flow.

Here also there have been revolutions, starting almost with each change of the moon, for a generation or more. The country is perhaps the most backward in the New World. They never plant anything. Haiti grows a considerable amount of coffee, but it grows on trees which are now the wild descendants of the trees which were planted by the French colonists.

Porto Rico feels that the completion of the canal spells new prosperity for it. Plans are on foot for a magnificent tropical hotel, to be built at San Juan. Being hard by the natural route for ships between the canal and Europe, it expects to profit by the traffic as Genoa profited

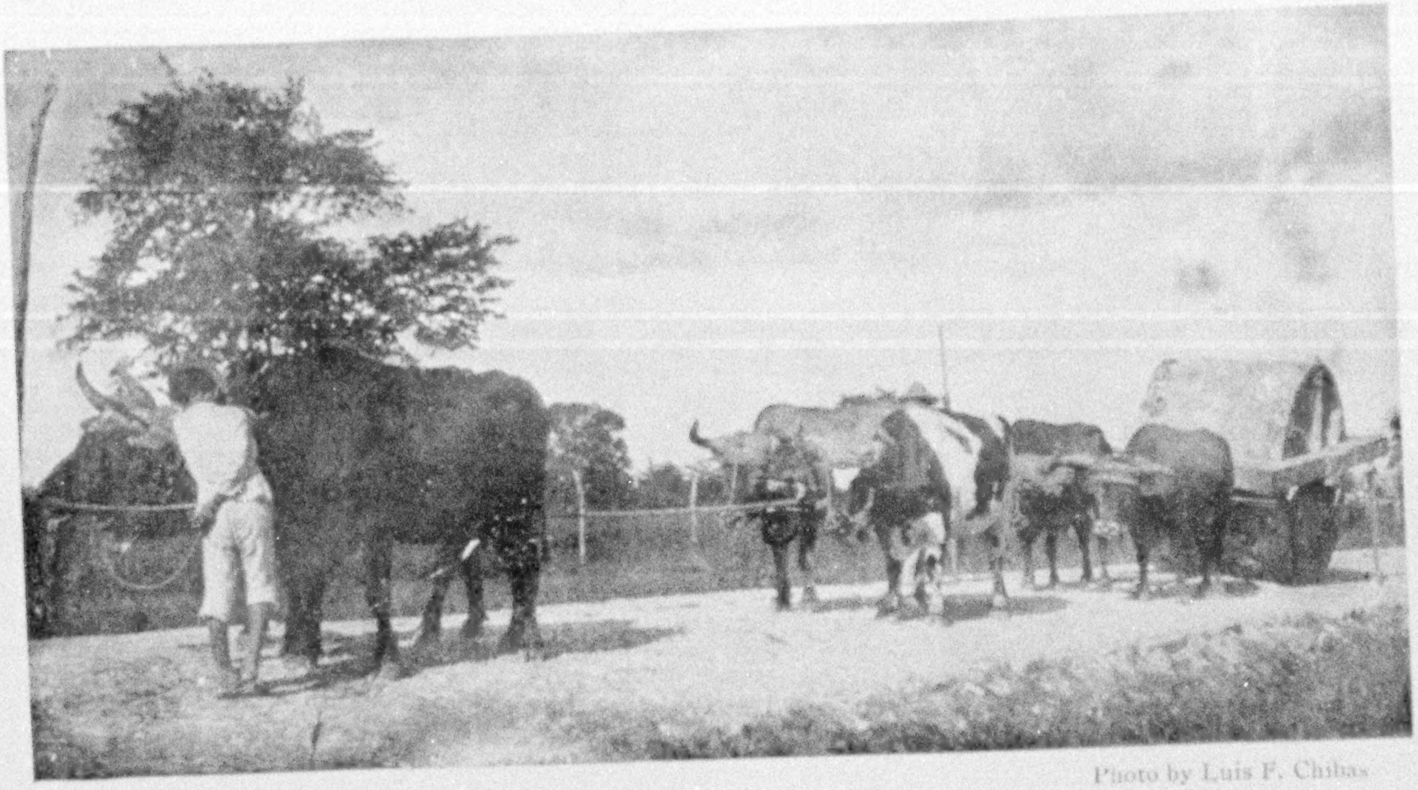


Photo by Luis F. Chibas

ROAD-MAKING IN CUBA, WITH FOUR-TON ROLLER, IN THE INTERIOR OF THE ISLAND

Cuba has always been handicapped by a lack of good roads, and one of the greatest blessings of the American occupation was the initiation of an era of road-making

Photo from Frederick J. Haskin

A HAVANA BABY ENJOYING ITS MIDDAY LUNCH

This is by no means an uncommon sight in the poorer quarters of almost any Cuban town. All through the tropics and particularly among the Latin peoples the goat is a domestic animal of greater value than the cow. Its milk is preferred for infant feeding, and it needs less care and attention than the cow.

XUM

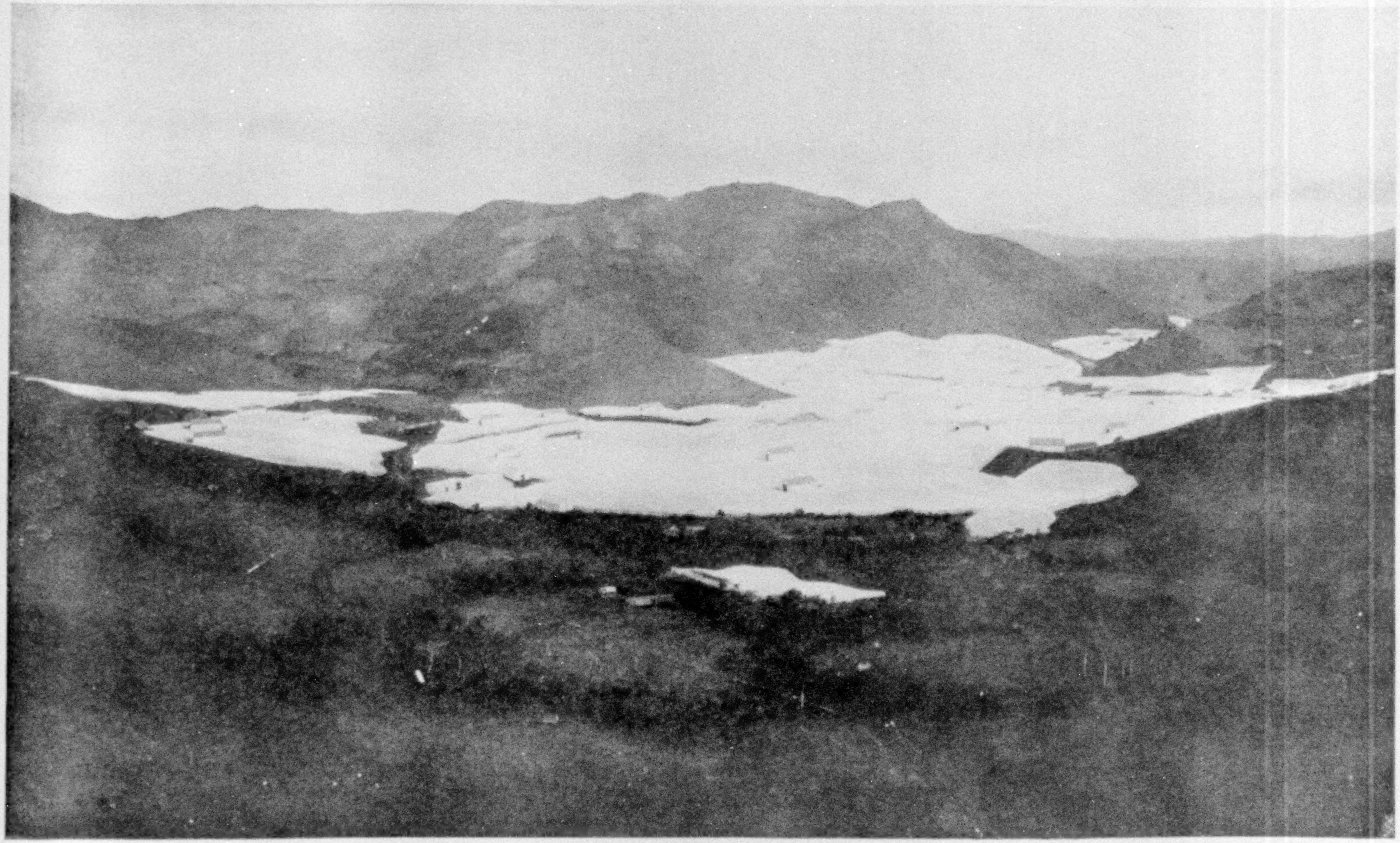


Photo from Bureau of Insular Affairs

A TOBACCO PLANTATION: LA PLATA, CAYEY, PORTO RICO

This picture shows one of the refinements of tobacco growing, the use of cheese-cloth to cover the growing plants. It has been found that tobacco, protected in this way, is much more valuable than that grown in the open. The leaf is lighter in color and weight; the texture is much finer, yielding a larger number of leaves suitable for cigar wrappers. The tobacco is also much purer and has a lesser amount of nicotine, gum, cellulose, and resin than the open-grown leaf. This tent system of production is used in Cuba as well as in Porto Rico.

Photo by George R. King

THE BARRACKS AT LA UNION, SALVADOR

The port of La Union possesses the best harbor in San Salvador—deep, land-locked, and secure in all weather. It is the outlet for all the produce of the eastern half of the republic. The town, which stands between the harbor and the foot of the volcano of Conchagua, is a typical Central American city—ill-built, ill-paved, and ill-lighted. As usual, the most substantial buildings are the barracks, the jail, and the churches.

Photo by Louis Boury

CARTAGENA, COLOMBIA

Cartagena is the principal naval station of Colombia, and has the best harbor on the north coast of South America, occupying an area of about 62 square miles. Although possessed of considerable trade, the city has no modern quays, and large vessels have to discharge into lighters, as they cannot approach within a mile of the landing. There is, however, a railroad pier, some 120 feet long, which permits smaller vessels to discharge alongside. The city, with its green patios and red roofs, is very attractive to the eye, but has the reputation of being most unhealthy, especially to those unacclimated. Its climate, however, does not seem to effect the natives, of whom a large proportion are of negro descent.

Photo by Louis Boury

CARTAGENA, COLOMBIA

Cartagena is the most important of the seaport cities of Colombia, fronting on the Caribbean. It is an ancient city, dating from 1533, and has twice been captured by pirates—once in 1585, by the famous Sir Francis Drake, who exacted a very large ransom before departing. The city was once the headquarters of the Inquisition in South America, and the building it occupied is still extant. Cartagena is an episcopal see, but its cathedral does not compare with the beautiful old Jesuit Church of San Juan de Dios, whose marble pulpit is considered the finest work of its kind in all America.

Photo by Louis Boury

CARTAGENA, COLOMBIA

The houses in Cartagena are built in the old Moorish style, originally imported from Spain. The open, tree-planted patio in the center is the focus of the family life, and on to it all the rooms of the house open. Very little adobe is used, and in the older houses the walls, of brick or stone, are often 3 feet thick. The windows and doors giving on to the street are heavily barred, so that the houses have a fortress-like appearance. The importance of the shady patio and the thick walls can be appreciated when it is realized that the mean annual temperature is no less than 82 degrees Fahrenheit.

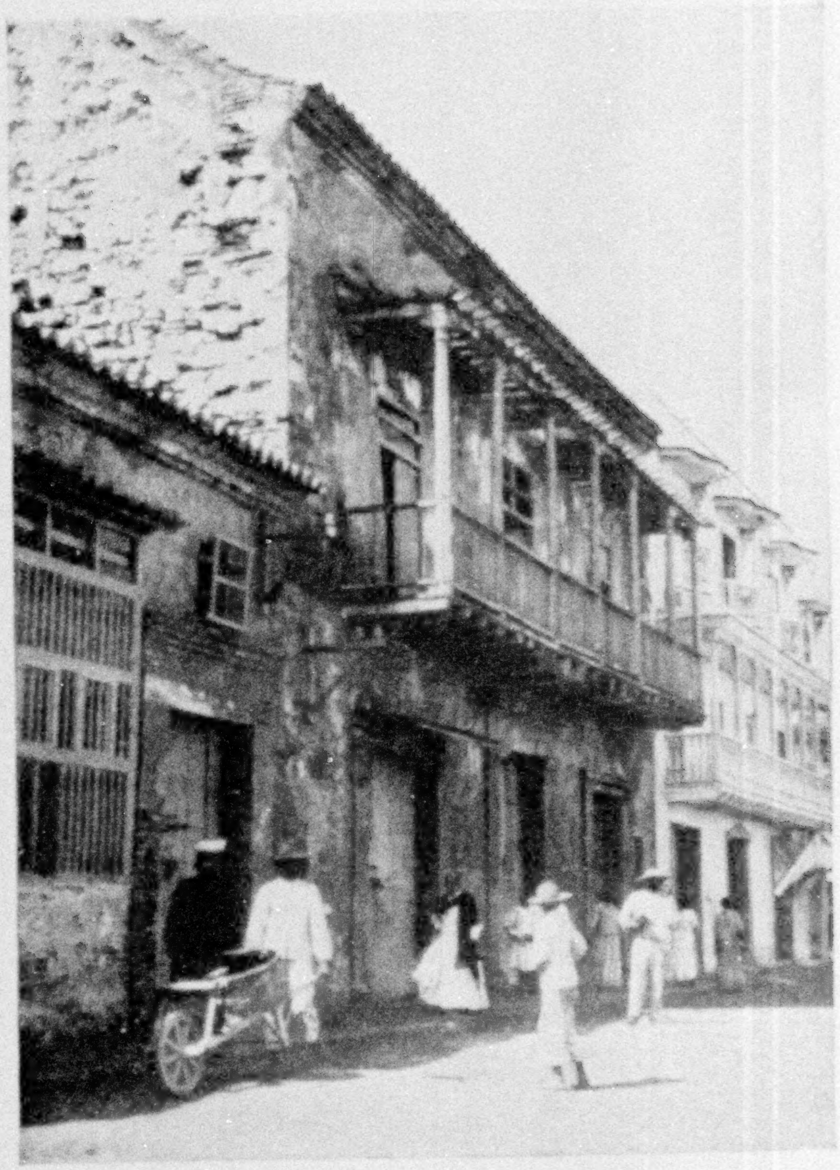


Photo by Louis Boury

CARTAGENA, COLOMBIA

The old city of Cartagena is built on a peninsula joined to the mainland by a narrow causeway. It is inclosed by walls and defended by forts dating from the 16th century. These forts, long since dismantled, are still in a good state of preservation. The streets are generally narrow and tortuous, paved with cobble-stones, but lighted by electricity, while through some of them pass electric cars connecting the city with the suburbs of Xiximani, on another island. There is an admirable water supply, due to an English company, which brings the water from Turbaco, 300 feet up in the hills, behind the town, where most of the wealthier merchants have their homes.

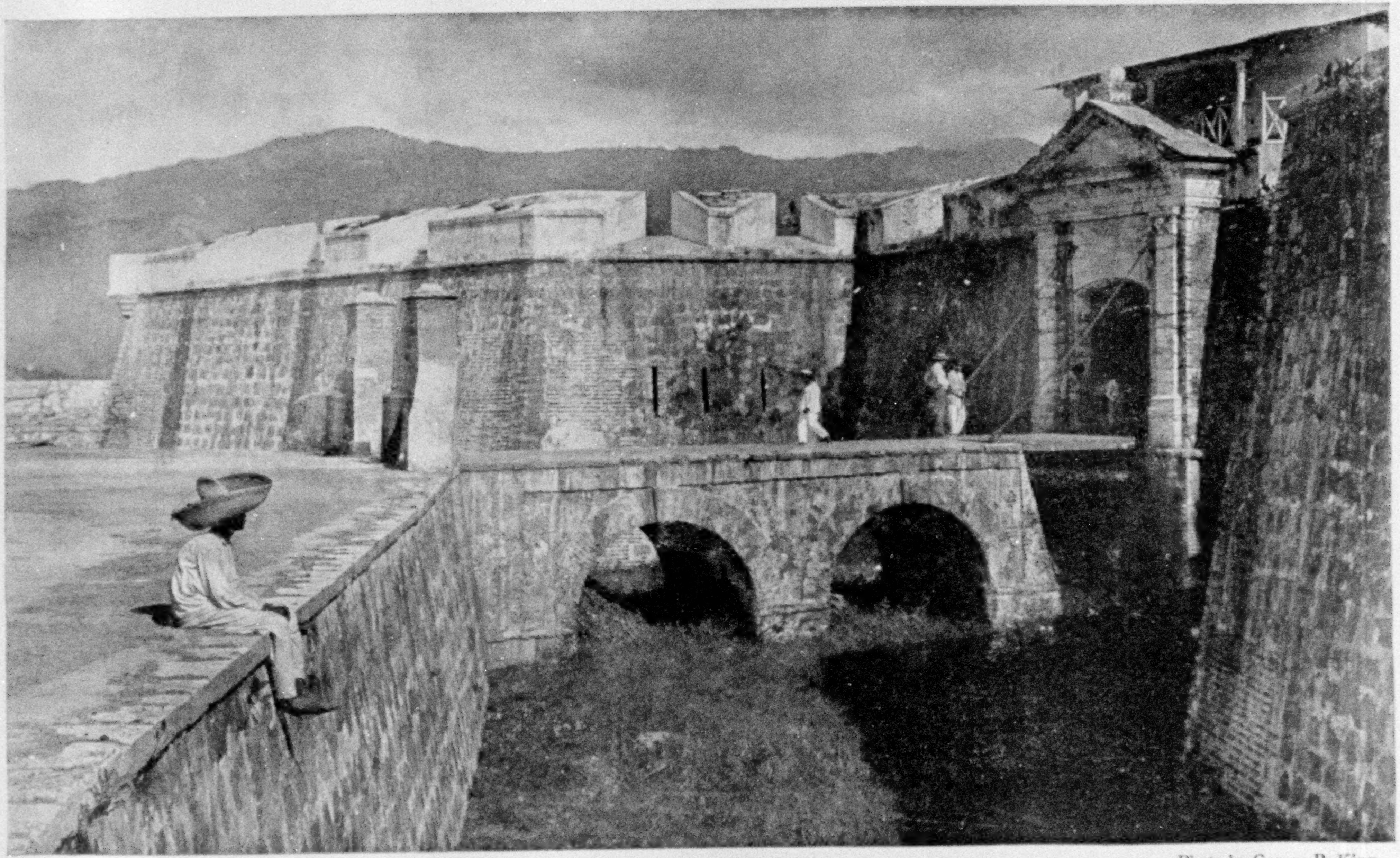


Photo by George R. King

FORT AT ACAPULCO, MEXICO

The whole of the Caribbean is dotted with towns which still preserve some of those fine buildings erected by the Spaniards in the 16th and 17th centuries, when money and time were matters of no object. As befits a great religious and military nation, the churches and the forts received the highest attention. While many of the old Spanish fortresses can be found on the Caribbean, the finest example still remaining is at Acapulco, on the Pacific coast of Mexico, which in Spanish times was a city of great importance as the only depot for the fleets which ran to and fro between Mexico and the Spanish possessions in the Far East.

by the Mediterranean traffic before the Turks took Constantinople.

Cuba also is expecting vast opportunities for development and expansion growing out of the operation of the canal. The Cubans are so enthusiastic as to propose the cutting of a canal through the island just west of Havana large enough to accommodate all the shipping that passes from the Atlantic seaboard to Panama and *vice versa*.

It is not unreasonable to assume that if the people of Middle America can secure fair and proper governmental conditions after the completion of the Panama Canal, they can do what Cuba has done in the 13 years since the first American intervention.

Since that time the number of people in the island able to read and write has increased 140 per cent. The mortality rate has been cut down from 33.68 per thousand to 12.69, and only Australia, among all the countries of the world, can make a better showing.

The balance of trade has risen from a deficit of $27,000,000 a year to a surplus of $30,000,000. The mileage of macadam roads has increased from 158 miles to 928. Some $350,000,000 has been spent since then in the rehabilitation of the country. And even then Cuba's government has not been all that it might be, nor is it at the end of its possibilities of progress. Only a bare fraction of its agricultural lands are under cultivation; only a part of its mineral wealth has been developed. It might easily be made to quadruple its foreign trade.

But assuming that Central America can only be brought up to the standard of Cuba today, its foreign trade would amount to a full billion dollars a year instead of a beggarly 65 million today. It would have 10,000 miles of railroad where it has less than 1,000 miles today. It would have 5,000 miles of macadam roads as compared with a few hundred today. It would have a population of 11,000,000 as compared with 5,600,000 today.

This and more will certainly come to Central America if good government there comes apace with a completed Panama Canal.

IMPORTANT NOTICE TO OUR READERS

OWING to the very large increase in the edition of the National Geographic Magazine, the capacity of our printers, who have the largest printing establishment in Washington, has been temporarily overtaxed, with the result that the magazine is many weeks late. In September, 1912, we were printing 140,000 copies, whereas the edition for January and February had leaped to 210,000 copies. The present magazine also makes a larger book.

This increased popularity of the magazine is very gratifying; however, such an extraordinary growth was beyond all calculation.

Messrs. Judd & Detweiler, Inc., who have so admirably printed the magazine for 25 years, are now building a large new plant, which will be entirely devoted to the printing of the National Geographic Magazine. Meanwhile, new presses are being installed in their old building, and two shifts are working night and day. Every effort is being made to catch up with the calendar, and we hope soon that the readers will receive the magazine more regularly than has been possible in the past two months. Meanwhile, the members may rest assured that the increased edition will mean an even more valuable and entertaining magazine.

Photo by George R. King

SCENE IN SAN BLAS, MEXICO

Mexico still remains, in some respects, as primitive as when Cortez first landed on her shores. The picture shows how liquids are still transported today in the great earthenware vessels which have been used from time immemorial. Note the sandals used by the rider of the donkey on the right. San Blas, despite its open and exposed roadstead and its unhealthy climate, has a considerable trade—lumber, silver ore, and copper being exported in large quantities.

PROGRESS OF THE NATIONAL GEOGRAPHIC SOCIETY

The Reports for the Year 1912 of the Director and Editor, the Secretary, and the Treasurer

REPORT OF THE DIRECTOR AND EDITOR

THE results of the year 1912 were most gratifying in all departments of the Society's work. In the variety and extent of researches and explorations by the Society; in the number of new members added to the rolls; in the popularity, influence, and educative value of its magazine, and in the amount added to the investment fund, the year 1912 surpassed all its predecessors.

The expedition which the Society, in coöperation with Yale University, sent to Peru, under the direction of Hiram Bingham, made a careful study of the wonderful Inca city of Macchu Pichu, discovered by Mr. Bingham in 1911. The expedition stayed in this city for nearly five months, mapping it in such detail that a model can now be made of Macchu Pichu, which is one of the most extraordinary archeological finds in America during the past 50 years. The city covers the top of a high mountain, being one-half mile long and almost as wide. The buildings are built of blocks of pure white granite, put together without cement. The publications by the Society of the results of Dr. Bingham's expedition, which also made many other new discoveries, illustrated profusely by the remarkable array of photographs that he brought back, will bring much honor and credit to the Society for its share in the work. (The April number of the Magazine will contain Dr. Bingham's report.)

The expedition to Mount Katmai, Alaska, to study volcanic conditions of the mountain and neighborhood, was also very successful. Prof. George C. Martin has completed his report, which is illustrated by a marvelous collection of photographs showing the devastation caused by the volcano. (Published elsewhere in this number.)

The expedition to the east coast of Hudson Bay, under the direction of W. E. Clyde Todd, did good work, and its biological and other studies should prove valuable acquisitions to science.

The scientific volume of the Alaska Glacier studies of 1909, 1910, and 1911 was completed by the late Prof. Ralph S. Tarr, of Cornell University, and Prof. Lawrence Martin, of the University of Wisconsin, and delivered to the Society late in the year. It will be published in 1913.

The present activity of the Society in conducting explorations is most gratifying when we realize that until very recently the Society had no funds of its own available to maintain researches.

THE NEW BUILDING OF THE SOCIETY

As the Society has no endowment, it has been the policy of the Board of Managers each year to add to the reserve fund as large an amount as possible from the annual receipts, in order that the Society might accumulate a comfortable surplus and thus be protected in times of financial stress. The wisdom of this policy is now apparent, when, owing to the immense increase in the correspondence and business of the Society, more accommodations are needed for its office force than Hubbard Memorial Hall can provide, and the erection of a new office building for the Society has become imperative. In December, 1912, the Board of Managers authorized the construction of a new building on the large property, which the Society had purchased at a cost of about $44,000, adjacent to Hubbard Memorial Hall.

The Finance Committee, which the Board charged with the duties of preparing plans, is now actively at work on the designs for the new building, which will be convenient, well-lighted, and a handsome annex to the beautiful home given to the Society by the family of its

first President. It is expected that ground will be broken for the new building about April 1, and that it will be ready for occupancy before November 1, 1913. The building and equipment will cost approximately $150,000, exclusive of the land.

When the new structure is completed Hubbard Hall will be restored to the original purposes for which it was intended—a meeting-place for geographers and travelers, for the research and other committees of the Society, and for the accommodation of a useful geographical library of ready reference. The Society has several thousand standard geographical books, but owing to the crowding of its present quarters, the volumes are for the most part stored in packing-boxes.

Fourteen years ago an able-bodied man could walk off with the entire month's edition of the magazine on his back, whereas today seven freight cars are required to carry the paper for printing the current number of the magazine. The number of the magazine which contains this report would fill a book-shelf 1½ miles long. This really extraordinary development of a magazine which prints no fiction has been made possible largely because of the belief of the old and new members in the object of the Society and of the loyal support which they have given to its policy of popularizing geographical knowledge, particularly as expressed in its magazine.

During 1912 there was a uniform growth in new members and in receipts of approximately 60.5 per cent over the preceding year, the largest percentage of increase that the Society has attained during the past six years. I give below a table showing the progress of the Society in its membership, in its receipts, in its earnings, research expenditures, and investment for each of the last six years. It is there shown that the membership, the receipts, and the earnings for the year 1912 were practically four times the corresponding figures for the year 1908.

	Members.	Receipts.	Surplus after payment of all expenses of the year.	Appropriated for research.	Invested.
1912	160,565	$369,829.34	$64,564.31	$13,740.76	$50,823.55
1911	102,051	224,927.12	43,886.96	5,200.94	38,686.00
1910	74,018	168,863.43	36,872.00	8,766.00	28,096.00
1909	53,333	127,275.70	25,466.07	5,746.39	19,719.68
1908	38,698	84,083.54	16,898.00	None	16,898.00
1907	31,272	80,707.29	19,013.00	1,729.15	17,283.85
Total			$206,700.34	$35,183.24	$171,507.08

Total investments and cash of the Society (December 31, 1912) $177,060.00

This increased growth of the Society will provide funds for an even more valuable magazine in 1913 than the Society has yet been able to publish. Several new maps and panoramas, including another wonderful mountain panorama by Dr. Charles D. Walcott, Secretary of the Smithsonian Institution, and several colored features will appear in early numbers of the magazine. Each number of the magazine will contain splendid articles by eminent authorities, and an average of from 125 to 150 of the marvelous illustrations which have given the magazine its unique reputation for interest and instruction.

The magazine has been purchasing material in almost every part of the world and has today one of the most valuable collections of photographs in the United States. The Society has also a large equipment of machines, etc., which have been purchased during the past several years and none of which appear on the books of the organization as assets. The Society has a collection of copper plates worth many thousand dollars, also not carried as assets.

There were published by the Society during 1912 1,705,000 copies of the magazine, the average monthly edition for the year being 142,083, a gain of 48,666 per month. The average edition in 1911 was 93,417; in 1910, 68,833; in 1909, 52,833; in 1908, 41,000.

The Society is today the largest patron of the post-office in Washington, excluding the government departments. During the past year about 1,200,000 letters and 50,000 postal cards were dispatched from our office. Approximately 225,000 remittances were made to the Society, only a very small percentage of which were of a greater amount than $2. Forty-eight thousand changes in the addresses of members were made, more than 150 for each working day, and approximately 2,250 mail-bags of magazines were sent out each month.

The condition of the advertising department of the magazine is most promising for the current year. Our policy has been to limit the number of advertising pages and to refuse much advertising which we did not think desirable. For instance, advertisements of certain medicines, foods, real estate, etc., though carried by standard magazines, are not printed in the NATIONAL GEOGRAPHIC MAGAZINE.

The fact that the magazine has been built up out of membership fees and subscriptions, and has not been dependent on advertising receipts, has enabled us to be independent; furthermore, we have not had to maintain an expensive advertising staff.

Our policy is to limit the number of pages of advertising to be carried by the magazine to not more than 50 pages per month. Owing to the exceptional value of the advertising pages in the NATIONAL GEOGRAPHIC MAGAZINE, there is now beginning to be a great demand for them, and we expect shortly to command a much more remunerative price per page than has heretofore been obtainable.

The success of the Society in developing a popular magazine for the diffusion of geographic information monthly makes me believe that the Society should now undertake the publication of the ideal, or standard, books of travel. It seems to me that our aim should be to encourage a new type of geographical literature, just as we have encouraged and established a new type of geographical magazine. Our facilities for illustrating books of travel and for distributing them are unequaled. The market is flooded with books of travel every year, most of which are rubbish and not worthy of even a line of note in our periodical. They have a very small sale, because so many poor books of travel are published that the very rare good book is hidden in the mass of worthless material.

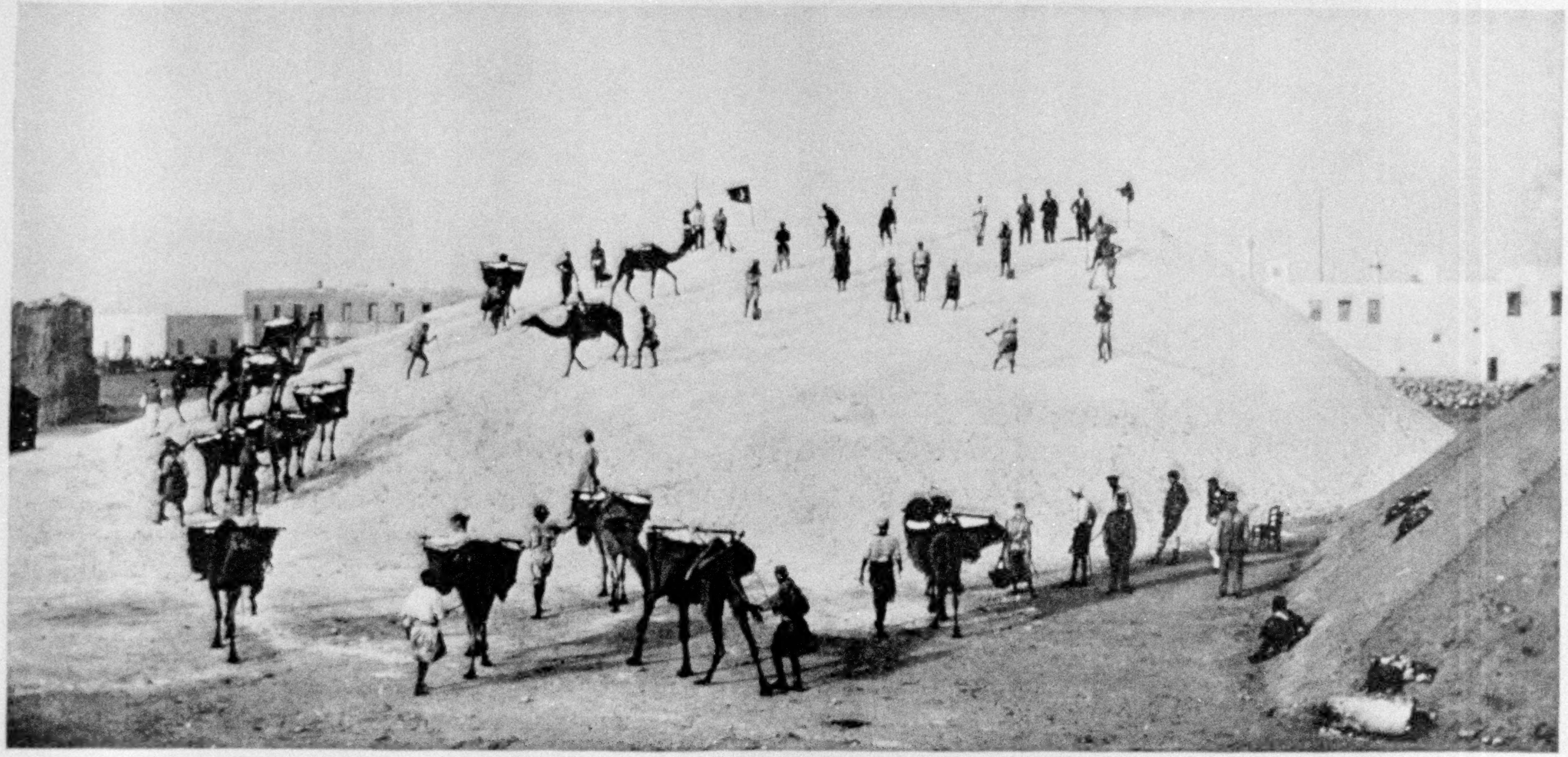
If the Society adopts the policy of printing exceptional studies of foreign peoples, such as "Farmers of Forty Centuries," by the late F. H. King, we shall undoubtedly receive applications from authors of such volumes who will want to have us undertake their publication because of the distinction that a work approved by the Society will merit from the public. We have such a tremendous field of readers that the Society ought to do all that it can to place useful geographical information before them.

Our aim is to make the magazine a source of desirable and useful geographic information to every intelligent family in the United States, and we believe that this ambition can be realized.

If the Society through its magazine can get the average man and woman in the United States to read articles like the one on "The Wonderful Canals of China," in the October (1912) number, we shall be doing an educational work which in importance cannot be overestimated.

The magazine is thus becoming one of the greatest forces in the world for a better understanding and appreciation of other peoples, and for the promotion of international good will. And in this connection I quote from an editorial in the *Boston Herald* as follows:

"The National Geographic Society of Washington, D. C., is doing a work, through the monthly publication of its magazine, which no intelligent man or woman can afford to remain ignorant of. Geography by itself is ordinarily thought a dry subject. Geography, on the con-



A SALT HEAP AT BENGHAZI

Benghazi, the second city in Italy's new African possession, is a town with more inhabitants than Tripoli, the capital of the Tripolitana. It is the terminal point of a great caravan route between the Central Sahara and the sea. In the vicinity are great salt marshes, the produce of which is brought day by day into the city on camel back and deposited in one of the large squares. In the course of a year these salt piles grow to the height shown in the picture before being prepared for export. Benghazi also does a very considerable trade in ostrich feathers, which are brought by caravan from Central Africa. The inhabitants are Berbers, but Italians and Jews are numerous.

trary, based on geology or the vivid presentation of the great physical features of the earth on which depend all civilizations, customs, avocations, sciences, and literatures, easily becomes one of the most fascinating of studies, or even of mere cursory skits of reading.

"Strange to add, in its bearing on such affections of the heart as ardent love of country and patriotic pride in its great foreordained destinies, here is an agency the force of which cannot be overstated. Indeed, the modern innovation of hatching chickens by incubators instead of hens is simply nowhere compared with the system of hatching patriots of the stamp of William Tell by geological geography, as exemplified in the faith and works of the National Geographic Society of Washington, D. C.

"This is no wild paradox. In truth, have not the gravest historians insisted that the reason why there is no such thing as the existence of patriotic sentiment in China is solely due to the fact that the human heart is incapable of loving 400 million fellow creatures one knows nothing about? They are a pure numerical abstraction to a man. Of their lives, languages, aspirations, joys, and sorrows he is ignorant of every concrete item, unless that they all wear the national pigtail; and so, even this dangling appendage is not potent enough to bind the people together in the chords of universal love.

"Just the same used to be asserted of the United States of America. The States were too big, too broadly dispersed, too divergent in interests, for any one to be capable of loving their multitudinous populations as fellow countrymen. All this, however, at any rate in the eyes of the National Geographic Society of Washington, is now rapidly being done away with. It is getting effected through a vivid appeal to the visual imagination which is enabling us all to see, in the mind's eye, our whole country at once and as a whole. The stupendous national enterprises already completed, or about to be inaugurated, are fast annihilating all lines of geographical division, and enlisting the minds and hearts of the scattered millions in vast undertakings in which all share a common interest and common pride."

In conclusion, you will permit me to call your attention once more to the fact that, notwithstanding the wide range of geographic subjects included in the magazine, covering archeological, geological, political, and historical themes, the standard of accuracy of fact has always been maintained. It is the reputation of the magazine for its unquestioned reliability and impartiality that is largely responsible for its popularity.

The great success of the year would not have been possible without the cordial coöperation and help of the assistant editor, Mr. John Oliver La Gorce; the assistant treasurer, Mr. F. B. Eichelberger; the assistant secretary, Mr. George W. Hutchison, and all the other members of the office force, to whom grateful acknowledgment is hereby made.

Respectfully submitted,

Gilbert H. Grosvenor,
Director and Editor.

REPORT OF THE SECRETARY

The year 1912 shows a large increase in the membership of the National Geographic Society and a general improvement in its condition and work.

The number of members December 30, 1911, was 102,051; the number added upon their own application from January 2 to December 31 was 59,161; the losses by death, by resignation, by nonpayment of dues was 5,876. There was also a net gain of 8,029 in the number of subscribers, making a net increase of 58,514 members and subscribers during the year and the total membership, including life members and subscribers on December 31, 1912, 160,565.

Fifty-five new life members were elected during the year, making the total life membership 505.

The membership is distributed throughout all the States and Territories of the Union, and includes about 3,100 in the District of Columbia and between 1,300 and 1,400 in the Philippines, Hawaii, Porto Rico, and Alaska. The membership in foreign countries is 3,550, and represents 50 different countries, including most of the European countries, Egypt, India, China, Japan, Australia, New Zealand, and the various Central and South American countries and several West Indian islands.

The membership in Canada is 1,550, in Mexico 550, in Cuba 350, in Europe 2,300, Central and South America 350.

In January, 1912, Mr. James Bryce, the British Ambassador, was elected an honorary member of the Society.

Respectfully submitted,

O. P. Austin,
Secretary.

REPORT OF THE TREASURER OF THE NATIONAL GEOGRAPHIC SOCIETY

For the Fiscal Year Ending December 31, 1912

RECEIPTS

Cash, as shown by statement of December 31, 1911		$42,876.92
Dues		264,499.74
Life memberships, 55 at $50		2,750.00
Magazine subscriptions and sales		28,243.08
Lectures		7,238.96
Advertising		41,446.43
Interest on investments		3,458.85
Interest on deposit in bank		687.87
Publications		20,251.02
Sundry		1,355.39
		$412,808.26

DISBURSEMENTS

Magazine, paper, printing, articles, etc.		$167,138.89
Pound-rate postage on magazine		13,000.00
Postage on letters, etc.		24,867.00
Salaries and services		54,331.90
Printing and stationery		16,036.67
Lectures		9,643.52
Hubbard Memorial Hall		1,769.53
Publications, scenes, panoramas, maps, etc.		28,863.08
Research:		
Alaskan glacier expedition, 1911	$759.28	
Alaska volcano expedition	1,500.00	
Peruvian expedition, 1912	10,000.00	
Hudson Bay expedition, 1912	500.00	
Instruments, research expeditions	976.83	
Sundry	4.65	
		13,740.76
Advertising commission		2,376.33
Library		208.20
Investment account, purchase of bonds, and real-estate notes secured by first mortgage		49,961.99
Equipment:		
Furniture	$1,177.75	
Machinery	1,912.48	
		3,090.23
Sundry		4,647.69
Cash balance in the Washington Loan & Trust Company		23,132.47
		$412,808.26

ASSETS

Investments, General Account

5% notes, secured by first mortgage on real estate		$47,300.00
Bonds:		
10 $500 bonds, Capital Traction Co., 5%, at purchase price	$5,518.75	
8 $500 bonds, Washington Gas Light Co., 5%, at purchase price	4,438.75	
10 $500 bonds, Georgetown Gas Co., 5%, at purchase price	5,427.50	
4 $1,000 bonds, Potomac Electric Power Co., 5%, at purchase price	4,135.00	
		19,520.00
Real estate:		
Lot 45, square 183, at purchase price	$11,338.95	
Lot 46, square 183, at purchase price	16,145.22	
Lot 47, square 183, at purchase price	15,876.00	
		43,360.17

Investments, Life Membership Fund

5% real-estate notes secured by first mortgage	$22,000.00
Publications on hand, cost price	21,750.00
Cash in the Washington Loan & Trust Company	23,130.47
Total assets year ending December 31	$177,060.64
Total assets December 31, 1912	177,060.64
Total assets December 31, 1911	126,237.09
Increase in assets in 1912	$50,823.55

LIABILITIES

None.

Respectfully submitted.

JNO. JOY EDSON,
Treasurer.

THEODORE B. STARR, INC.

JEWELERS SILVERSMITHS

Pearl Necklaces

THE subtle variations in color, lustre, shape, and texture of Pearls explain the necessity for most expert judgment and infinite patience in grading and matching.

We now invite inspection of a large number of Pearl Necklaces of exceptional quality, many of which have required years to complete.

Particular attention is given to the enlarging and improving of necklaces.

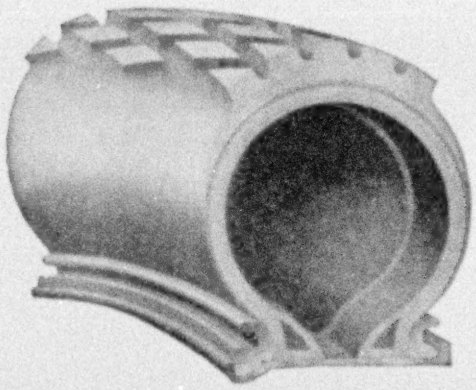
Prices never higher than prevail elsewhere for equal quality.

5TH AVENUE AND 47TH STREET
NEW YORK

Established 1862

XUM

No-Rim-Cut Tires



One Glance Tells You

1—That This Tire Can't Rim-Cut

There are no hooks on the base, as with clincher tires.

The tire is held on by our patented feature—by six flat bands of 126 braided wires, vulcanized into the tire base. That makes the tire base unstretchable.

So your removable rim flanges are set to curve *outward*, not *inward*, as with old-type tires.

And the tire, when wholly or partly deflated, rests on a rounded edge.

2—That This Tire Can't Skid

These deep-cut, sharp-cut blocks present to the road surface countless edges and angles, facing every direction. They give a bulldog grip.

The tread is double thick, and the extra tread is of very tough rubber, so the non-skid feature lasts.

The blocks meet at the base, so the strains are distributed over the fabric the same as with smooth-tread tires. That Goodyear feature immensely increases the life of a non-skid tire.

3—That This Tire Is Oversize

We say 10 per cent oversize. But careful comparison with six makes of clinchers shows the actual oversize, in air capacity, to be 16.7 per cent.

Even 10 per cent oversize, under average conditions, adds 25 per cent to the tire mileage. It takes care of your extras. It saves the blow-outs due to overloading.

No need to take any one's word for these things. One glance at these tires at any Goodyear shop will prove them in a moment.

10% Oversize

Users Will Tell You They Save 48%

250,000 Know

Not less than 250,000 motorists now use Goodyear tires.

They have tested out about two million tires; and, in these days of odometers, they don't guess at results.

These facts tell the verdict:

Goodyear tires now far outsell every other tire.

Last year's sales by far exceeded our previous twelve years put together. Yet the demand exceeded our output by some 400,000 tires.

As per contracts now made, nearly half of this year's new cars will go out with Goodyear equipment.

Average Savings

On the same car, under the same conditions, the average saving through No-Rim-Cut tires is almost half one's tire bills.

On some cars and on some roads this means enormous mileage. On other cars, which are under-tired, the mileage will be less.

But the average saving, as compared with old-type tires, doesn't greatly vary.

No-Rim-Cut tires save every penny that rim-cutting costs.

Their 10 per cent oversize, by increasing the mileage, saves 25 per cent.

On Non-Skid tires the saving is larger, Because our inventors, in ways described, have added immensely to the life of non-skids.

How to Prove It

The way to prove it is to make a comparison, as hundreds of thousands have done.

Our sales figures tell you what their judgment has been. And your own eyes can see the apparent advantages.

Figure what it would mean if these tires do save you almost half your tire bills. Is it not worth proving out?

For thirteen years we have held the belief that the tire which gave the greatest service would become the favorite tire.

We have seen the time when Goodyears held only 1 per cent of the tire trade.

We have seen the demand take enormous strides, until this tire outsold all.

Now, for your own sake, we ask your comparison. And we shall accept your verdict.

Write for the Goodyear Tire Book—14th year edition. It tells every known way to save tires.

GOODYEAR

AKRON, OHIO

No-Rim-Cut Tires

With or Without Non-Skid Treads

THE GOODYEAR TIRE & RUBBER COMPANY, AKRON, OHIO

Branches and Agencies in 103 Principal Cities   More Service Stations Than Any Other Tire.

We Make All Kinds of Rubber Tires, Tire Accessories and Repair Outfits.

Main Canadian Office, Toronto, Ont.; Canadian Factory, Bowmanville, Ont.   (956)

Each a Lucky Car

By R. E. Olds, Designer

In every make an occasional buyer gets a lucky car. No repairs, no br aks, no troubles. Every part stands every strain.

In Reo the Fifth such things are not luck. I spend $200 per car to insure them. And this is how I do it:

Making Sure

I know, in the first place, after 26 years spent in building cars, how much strength is needed.

To that needed strength I add 50 per cent. Each driving part, by actual test, is made ample for 45-horsepower. That leaves a big margin of safety.

To make sure of this strength, I twice analyze every lot of steel.

I test my gears in a crushing machine of 50 tons' capacity.

I test my springs in another machine, for 100,000 vibrations.

Costly Extremes

In Reo the Fifth I use 190 drop forgings. Steel castings cost but half as much, but a casting often has a hidden flaw.

I use 15 roller bearings, Timken and Hyatt. The usual ball bearings cost one-fifth as much, but they often break.

I use a $75 magneto to save ignition troubles.

I doubly heat my carburetor to deal with low-grade gasoline.

A centrifugal pump is employed in this car to insure perfect circulation.

I use big tires to cut your tire expense. I have lately added 30 per cent to my tire cost to add 65 per cent to your tire mileage.

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Our factory process insures to each car almost a thousand inspections.

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Each engine is tested 20 hours on blocks and 28 hours in the chassis. There are five long-continued tests.

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These things are expensive. They add to the necessary cost of this car about $200, I figure.

But they save the user immensely more in repairs and upkeep.

So we save by factory efficiency, by building only one model, by making all our own parts. And we put that saving, for your sake, into these hidden parts.

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Reo the Fifth has a center control which you won't go without when you see it.

All the gear shifting is done by moving a handle only 3 inches in each of four directions. It is done with the right hand—not the left hand. And the handle is out of the way.

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This arrangement permits of the left-side drive, to which the best cars are coming. The driver sits close to the cars he passes, as the law requires in Europe.

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The tonneau is roomy, the seats are wide. The car has ample wheel base. And every detail shows the final touch.

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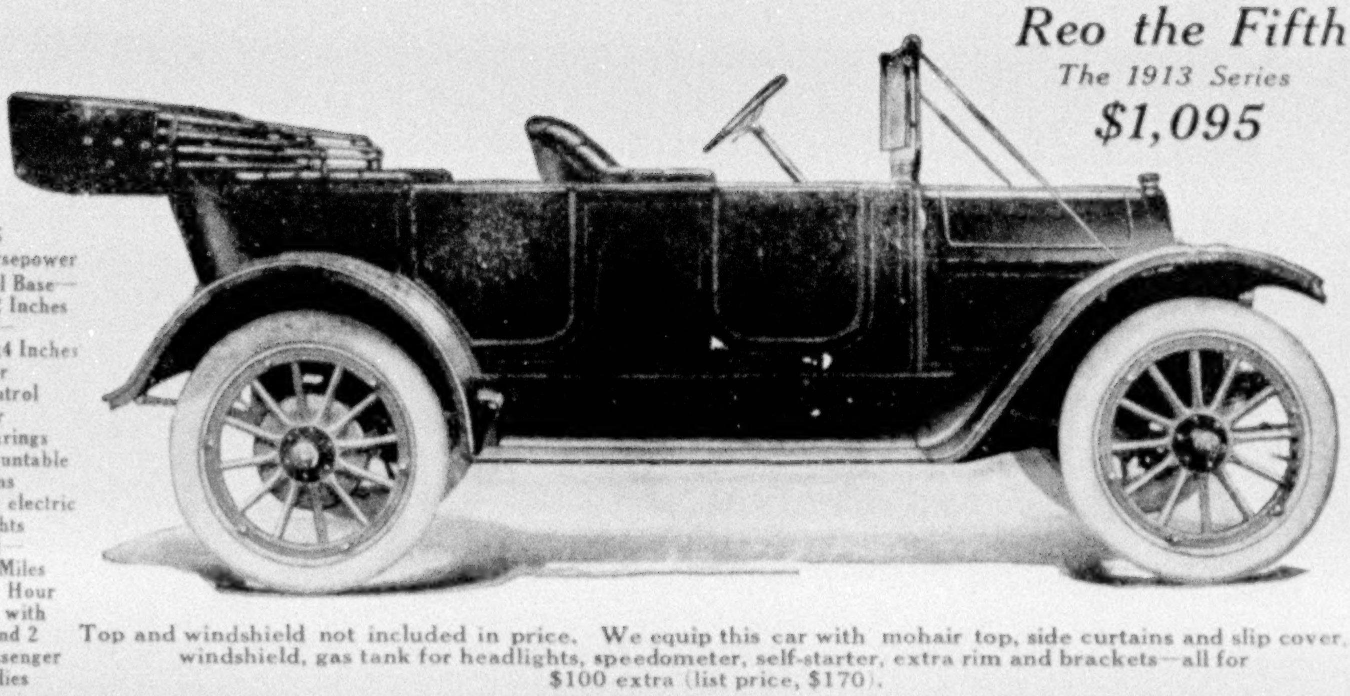

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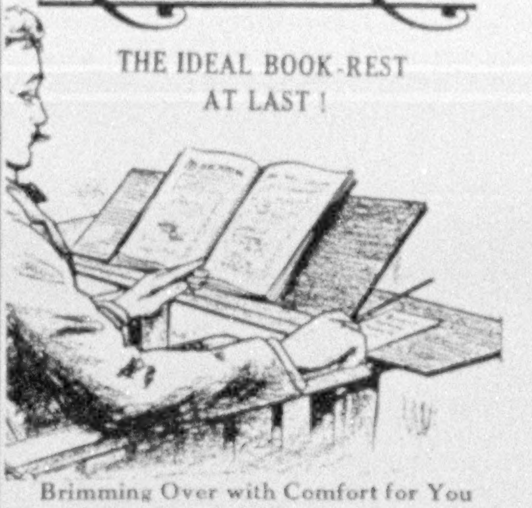

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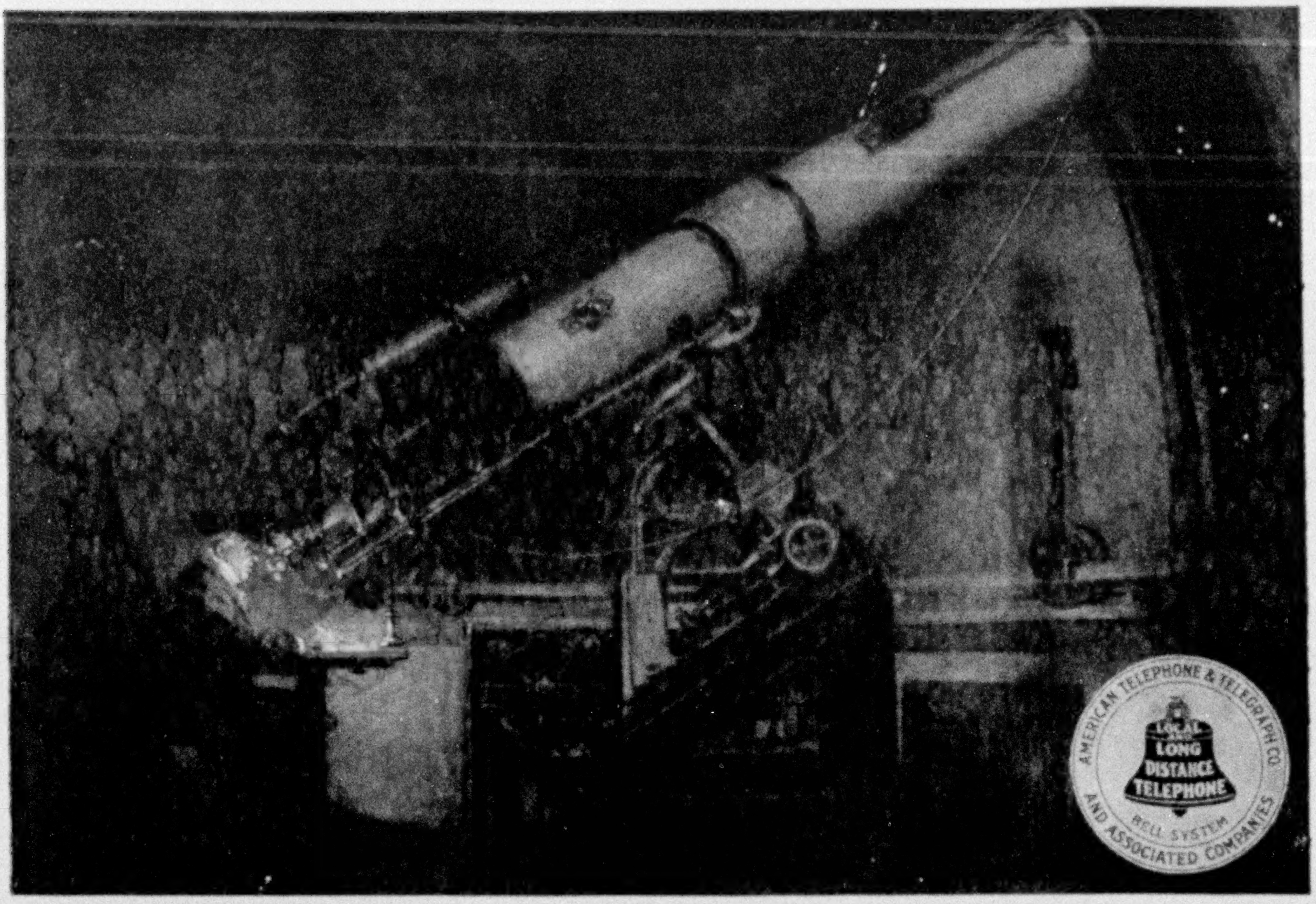

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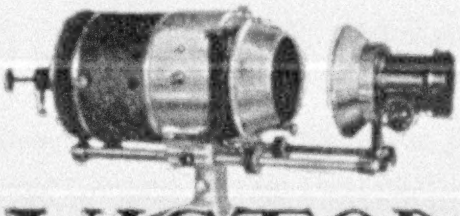

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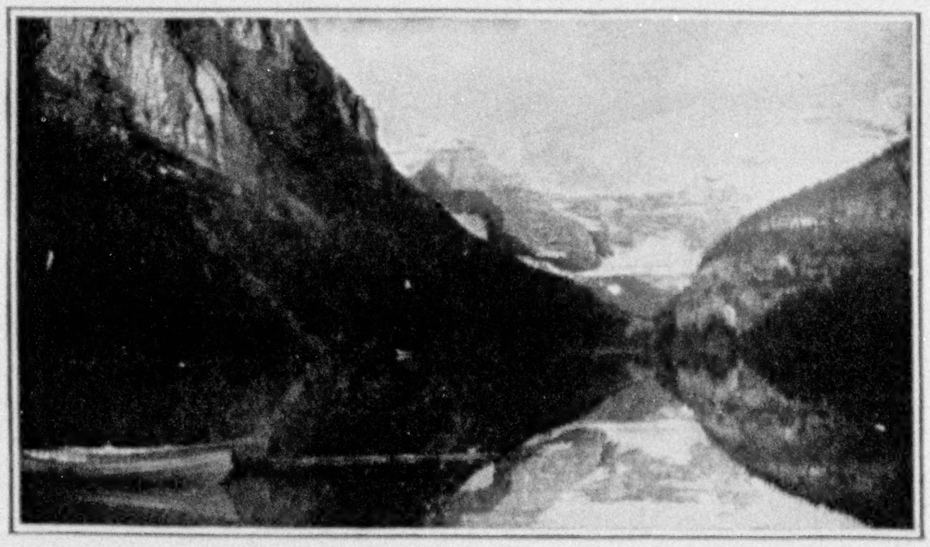

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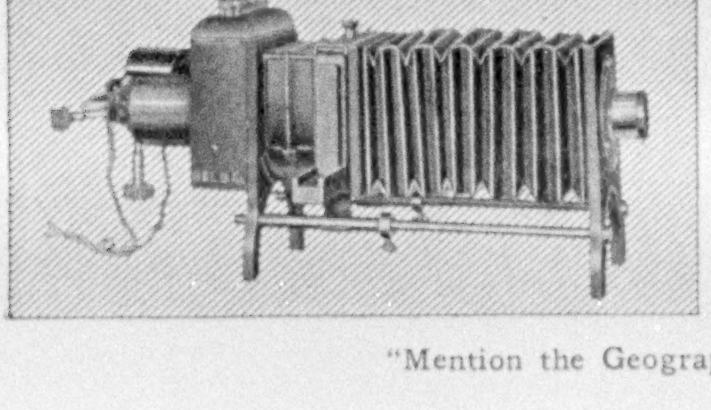

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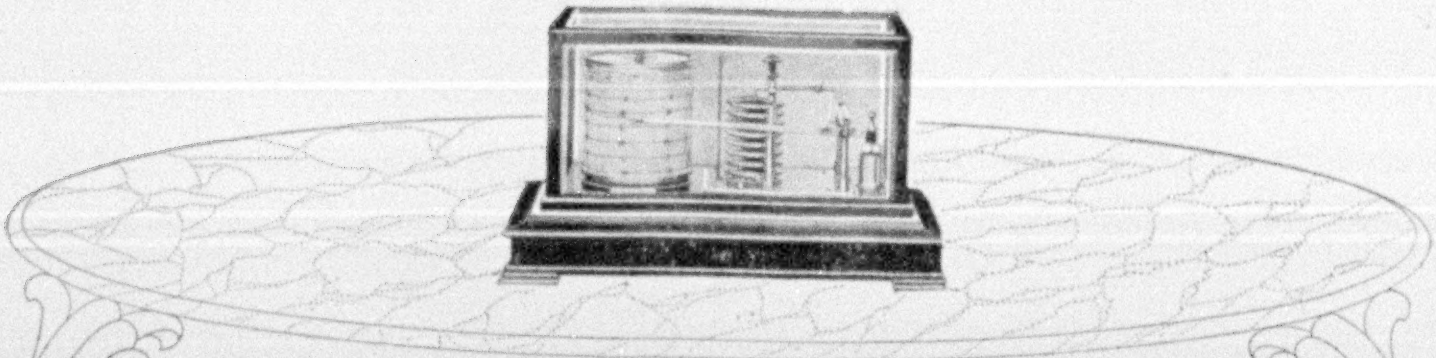

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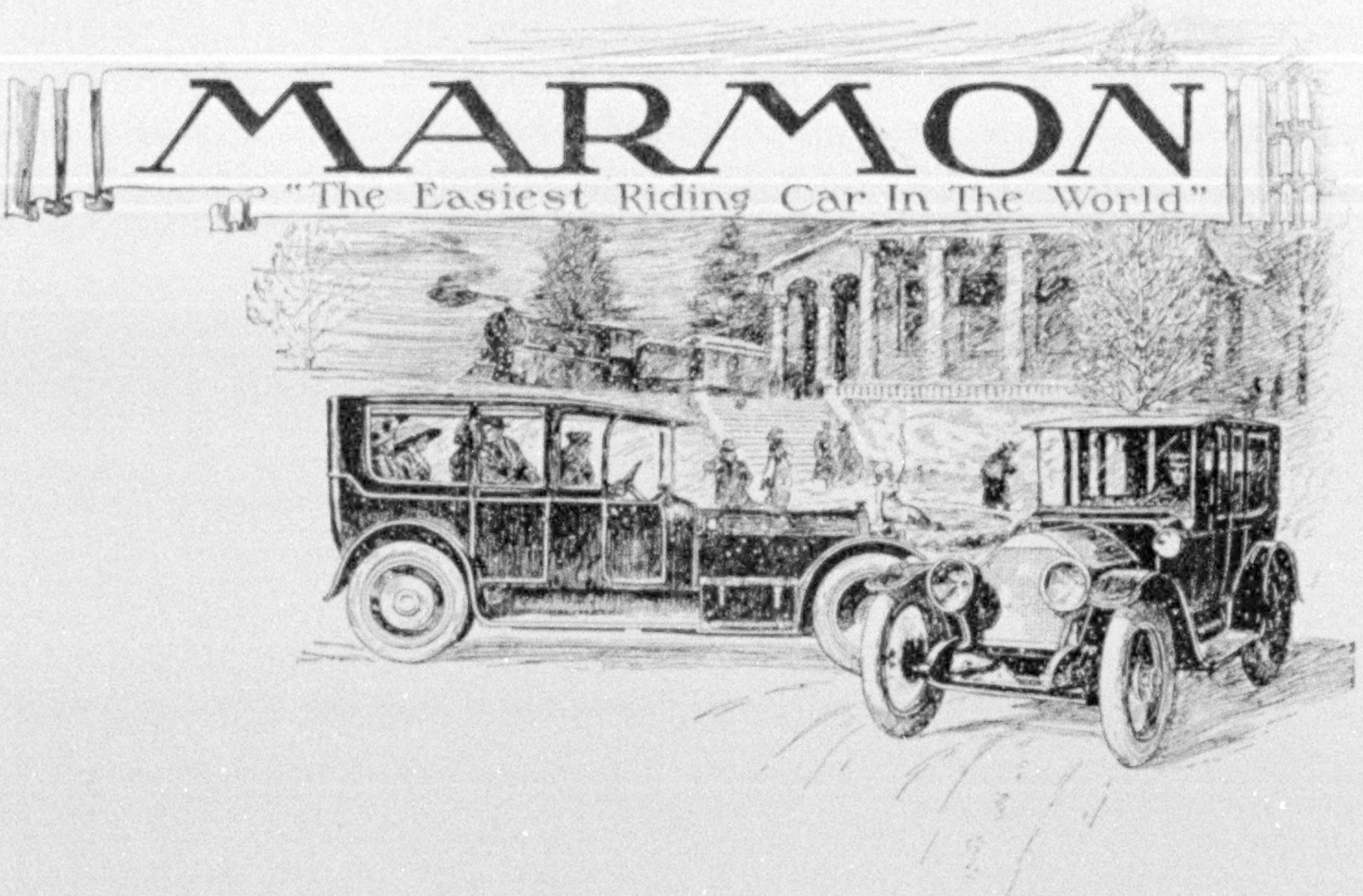

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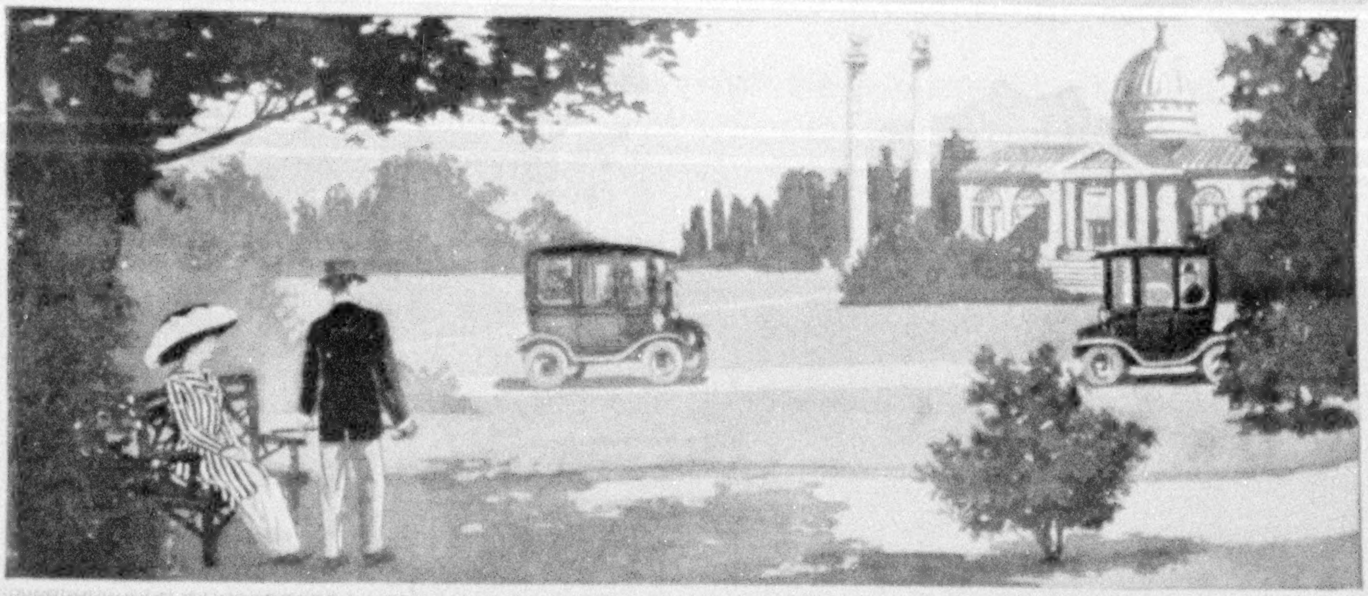

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876 "Exide" Distributors. 9 "Exide" Depots. "Exide" Inspection Corps.

Use the "Exide" Battery for Gas Car Lighting, Starting or Ignition.

"Mention the Geographic—It identifies you."

Sixteen years of unchanged unit construction tell why Goodrich Tires are the best for your car

FORTY-THREE years of successful rubber manufacturing are in Goodrich Tires We made the original American clincher automobile tires. That was sixteen years ago, when automobile tire-making began. The twenty-seven years of rubber experience that had preceded were crystalized in our principle of Unit Construction.

This principle demonstrated its soundness from the start, and Goodrich Tires always have been and always will be so made. You know what you are getting in Goodrich Tires—they are a protection to your automobile, and they give you comfort and mileage.

Goodrich Unit Construction Tires

Best in the Long Run

Made as a Unit

Unit Construction means just what it says—each Goodrich Tire is made as a unit. The unit idea prevails in the placing of the layers of fine rubber-impregnated fabric which build up the backbone of the tire, and in the finishing with the thick, tough tread of the purest rubber which is compounded in a way our forty-three years of knowledge of rubber makes us know will resist road wear.

The result is a unit tire which is bound to give both resistance and resiliency, as both tire users and automobile makers testify by their choice.

Each layer of fabric, each strip of rubber—every part of a Goodrich Tire, is placed just as accurate knowledge of the demands to be made upon it demonstrates is best.

Users' Opinions a Unit

Goodrich Tire users are a unit in recommending them. Over a million Goodrich Tires did not satisfy the complete demand in 1912. Our increased factory facilities will enable us to take care of the much greater demand in 1913. Makers of 175,000 of the 400,000 new automobiles which will be marketed in 1913 have already contracted for Goodrich Tires.

Fully half the automobile output of 1913 will go from maker to buyer with Goodrich Tires as the original specified equipment.

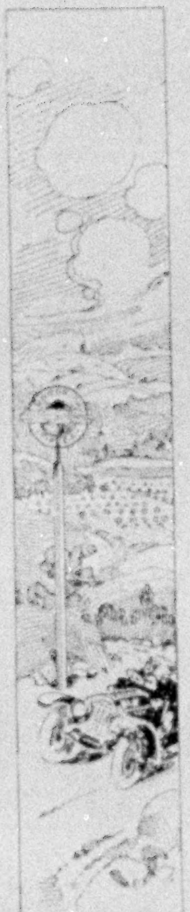
This overwhelming verdict of automobile makers and owners is the most tremendously convincing argument you can desire for the advantage to you, as a tire user, in Goodrich Unit Construction.

Cured as a Unit

The critical point in making a tire is the curing—the vulcanizing. To be perfectly cured, rubber requires just so much heat—*once*.

Goodrich Tires are cured as a unit. Body and tread are cured together in our vulcanizers under proper heat. The rubber impregnation of the fabric strips, the breaker strips, side strips and the thick, tough tread, in this most particular operation, literally *become one tire—a unit*.

This is the secret of the non-stripping of Goodrich treads. Our unit curing converts the built-up tire into an integral structure, strong, full of life. We wouldn't cure the tire twice, any more than you would bake a pie twice.



Write for Goodrich Route Book for your tour

Sent FREE

Wear as a Unit

Goodrich Tires wear uniformly. Curing them as units unifies their strength as well as their buoyancy. The thick, tough tread—extra heavy and extra strong—because of the unit curing, is perfect at every point. One inch wears the same as another.

The Goodrich unit construction gives the same dependable staunchness to the body of the tire—the inside. Body and tread are one—they cannot come apart—they hold and wear together.

This is what the tire user wants.

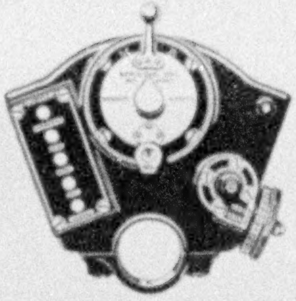
For all these reasons you owe it to yourself and your car to buy only Goodrich Tires

If you are an experienced automobilist you know immediately the value to you of the verdict of the makers of nearly half the 1913 output of cars.

If you are not, their decision, coupled with that of hundreds of thousands of experienced motorists, is worth even more to you. Don't get *your* tire knowledge from future experience. Benefit now by the experience and judgment of all this majority of makers and tire users, and begin with Goodrich Tires.

Goodrich dealers and service stations everywhere.

The B. F. Goodrich Company
Akron, Ohio



Packard Control Board

Answered by the Packard "38"

Why is a Packard at its best after thousands of miles of hard usage on the road?

Why will a Packard run so long without mechanical attention?

Why can a Packard run 30,000 miles without overhauling?

Why may a Packard owner start on a thousand-mile tour at a moment's notice?

Why will a Packard bought this spring have a higher relative cash value next fall, next spring or five years hence than any other car purchased at the same time?

Why does the discriminating buyer demand a Packard?

Ask the man who owns one

Here are some of the "38" features looking to safety, convenience and Maximum Service:

Left Drive	Short Turning Radius
Electric Self Starter	Six Cylinders Perfected
Electric Lighting	Dry Plate Clutch
Centralized Control	Forced Feed Oiling
Separate Magneto Ignition	Extra Large Crank Shaft
Hydraulic Governor	Six-inch Depth of Frame

The Bridge Builder's Factor of Safety

The sum of these essentials is to be found in no other car. This comprehensive solution in one motor carriage of all the chief problems of recent years compels the consideration of the critical patron.

Demonstration by any Packard dealer on any kind of road

Packard Motor Car Company, Detroit

THE FAMILY'S GIFT TO THE BRIDE

Wedding Silver
Dinner Services
Dessert Services
Tea Services
Flat Table Silver
Table China
Table Glassware

Special Photographs of Individual Pieces and complete services.

WEDDING GIFTS

can be selected by the far away purchaser by sending for

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which sets forth by engraving and description many beautiful and moderate priced gifts, including

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COLGATE'S

SHAVING LATHER

STICK - POWDER - CREAM

Whichever method you prefer—Stick, Powder, or Cream—you find in Colgate's the fullest measure of both comfort ***and economy.***

They all give the same creamy, "smartless" lather that softens the beard while being worked up with the brush—no mussy "rubbing in" with the fingers is necessary.

There is no waste.

Shaken on the wet brush, the last particle of Powder is as good as the first.

The Cream can be squeezed out to the very end of the tube.

Those who favor the Stick find economy as shown below.

Learn the comfort of a Colgate shave by sending 4 cents in stamps for a trial size of Stick, Powder, or Cream.

COLGATE & CO.
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199 Fulton St.
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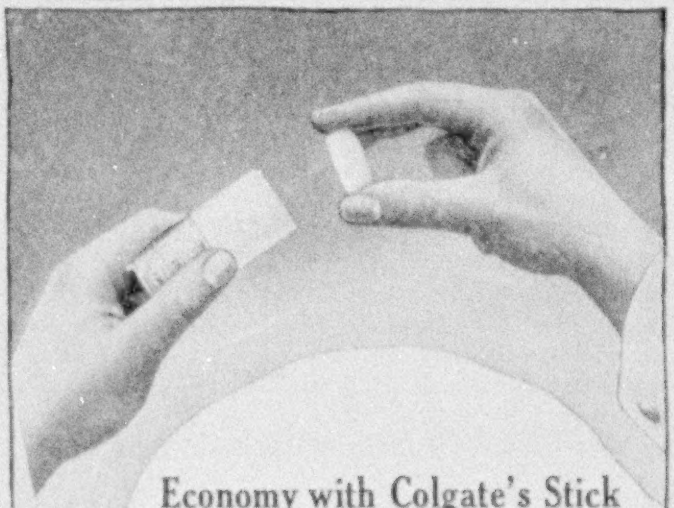
Makers of Cashmere Bouquet Soap—luxurious, lasting, refined.



Economy with Colgate's Stick

When the one you now have is nearly used up, wet it and press it firmly on the end of the new Stick. It stays—and you use every bit instead of having to throw away the last half inch or so as usual.

PRESS OF JUDD & DETWEILER, Inc., WASHINGTON, D. C.

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